

400 VMC series compressor

Operation and service manual



Vilter


EMERSON
Climate Technologies

VILTER MANUFACTURING CORPORATION

VILTER Multicylinder Compressor

OPERATING INSTRUCTION MANUAL 400 SERIES COMPRESSORS

READ CAREFULLY BEFORE INSTALLING AND STARTING YOUR COMPRESSOR.

The entire manual should be reviewed before attempting to install, service or repair the compressor.

A refrigeration compressor is a positive displacement machine. It is designed to pump superheated vapor. The compressor must not be subjected to liquid carry over. Care must be exercised in properly designing and maintaining the system to prevent conditions that could lead to liquid carry over. Vilter Manufacturing Corporation is not responsible for the system or the controls needed to prevent liquid carry over and as such Vilter Manufacturing Corporation cannot warrant equipment damaged by improperly protected or operating systems.

Vilter screw compressor components are thoroughly inspected at the factory, assuring the shipment of a mechanically perfect piece of equipment. Damage can occur in shipment, however. For this reason, the units should be thoroughly inspected upon arrival. Any damage noted should be reported immediately to the Transportation Company. This way, an authorized agent can examine the unit, determine the extent of damage and take necessary steps to rectify the claim with no serious or costly delays. At the same time, the local Vilter representative or the home office should be notified of any claim made.

TABLE OF CONTENTS

This manual consists of the following sections:

EXTENDED STORAGE PROCEDURES

INSTALLATION INSTRUCTION SECTION

This section should be read thoroughly before attempting to install a VMC Compressor. **IMPORTANT:** Local codes and ordinances should be checked beforehand so that violations do not occur, especially concerning devices for control and safety.

COMPRESSOR OPERATION SECTION

COMPRESSOR SERVICE SECTION

COMPRESSOR REPLACEMENT PARTS SECTION

Section 100R

Section 102R

Section 105R

Section 105X

EXTENDED STORAGE PROCEDURES

- A) If equipment is to be used for indoor duty, it must be stored in a heated enclosure. If the equipment is to be used for outdoor duty and will be stored outdoors, adequate drainage should be provided so water does not collect inside the base perimeter.
- B) All compressor stop valves are to be closed so the compressor is isolated from the remainder of the system. All other valves, except those venting to atmosphere, are to be open.
- C) Cover all bare metal surfaces (coupling, flange faces, etc.) with rust inhibitor.
- D) Desiccant is to be installed in the control panel (if applicable). If the panel is equipped with a space heater, it is to be energized. If the panel does not have a space heater, use a 50-watt light bulb. Use an approved electrical spray-on corrosion inhibitor for panel components (relays, switches, etc.)
- E) All pneumatic controllers and valves (if applicable) are to be covered with plastic bags with desiccant inside.
- F) On bare shaft compressors, a holding charge of oil pumped dry nitrogen should be placed in the compressor.
- G) If the compressor will be inactive for **ANY** length of time, the compressor should be rotated five (5) complete revolutions once every month. If a screw compressor is part of the system, the oil pump for the unit should be run for approximately two (2) minutes each week.
- H) Motors (NOTE: the following are general recommendations. Consult the manufacturer of your motor for specific recommendations)
 - 1) Disassemble and thoroughly clean the unit. (For periods over six months storage, repaint all previously painted surfaces, internal as well as external.) Do not contaminate the lubricant.
 - 2) Reassemble the unit. Insert one-half pound bags of silica gel (or other desiccant material) into the air inlets and outlets of drip-proof type motors.

NOTE: The bags must remain visible so they will be noticed and removed when the unit is prepared for service.

- 3) Cover the unit completely to exclude dirt, dust, moisture, and other foreign materials. At a bare minimum, slip a heavy, waterproof bag over the motor.
- 4) If the motor can be moved, it is suggested the entire motor be encased in a strong, transparent plastic bag. Before sealing this bag, a moisture indicator should be attached to the side of the motor and several bags of silica-gel desiccant put inside the bag, around the motor. When the moisture indicator shows the desiccant has lost its effectiveness, as by a change in color, the bag should be opened and the desiccants replaced with fresh ones.

Whenever the motor cannot be sealed, space heaters must be installed to keep it at least 10° above the ambient temperature.

NOTE: Rodents and other animals like to house inside motors in search of warm surroundings or food. Some of them attack the insulating materials. Their access to the motor should be restricted.

- 5) Rotate the shaft several revolutions once every month.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

INSTALLATION SECTION

TABLE OF CONTENTS

<u>PAGE</u>	
1	INTRODUCTION
1	DELIVERY INSPECTION
1	LOCATING THE UNIT
1	Drains
1	Ventilation
1	Servicing Space
1	FOUNDATION
4	Ground Floor Installation
5	Upper Floor Installation
6	Type "FLS" Vibration Isolators
6	Type "KIP-C" Vibration Isolators
8	FORMS AND TEMPLATES
8	CONSTRUCTION OF REINFORCED CONCRETE PAD
8	CONCRETE
10	SETTING AND LEVELING UNIT ON CONCRETE PAD
10	DIRECT CONNECTION DRIVEN COMPRESSOR UNIT
10	V-BELT COMPRESSOR UNIT
12	V-Belt Installation
13	V-Belt Adjustment – General Comments
13	Single "5V" V-Belt Adjustment
15	Banded (Joined) "5V" V-Belt Adjustment
15	V-Belt Removal For Servicing
15	ACCESSORIES AND ASSOCIATED EQUIPMENT
15	Oil Separator
15	General Description
17	Oil Separator Float Valve
17	Crankcase Heater
18	Oil Cooler
18	Introduction
19	Installation
19	Operating Pressure
19	Inspection
19	Service
20	Water Cooled Cylinder Covers
20	Water Regulating Valve
21	SAFETY DEVICES
21	ELECTRICAL EQUIPMENT AND SPECIFICATIONS
22	TESTING REFRIGERATION SYSTEM LEAKS
22	Ammonia Systems
23	Other Refrigerant Systems
23	Evacuating The System
24	COMPRESSOR OIL CHARGING
25	Oil For VMC Compressor

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

INSTALLATION SECTION

TABLE OF CONTENTS

(cont'd)

<u>PAGE</u>	
25	SYSTEM REFRIGERANT CHARGING
25	Equipment Inspection
25	Low Side Equipment
26	Compressors
26	Condenser
26	Controls
26	Refrigerant Charging
26	High Side Charging – Initial Charging
27	Low Side Charging – Adding Refrigerant To Operating System
28	THE INITIAL START
28	Controls
28	Final Precautions
30	MAINTENANCE SUGGESTIONS
29	Daily
30	Weekly
30	Monthly
30	Yearly
31	System Leaks
31	Year-Round Operation
31	Flushing The Oil Circuit
32	Crankshaft Seal Oil Leakage
32	Seasonal Operation
32	Service Contracts

ILLUSTRATIONS AND TABLES

<u>PAGE</u>	<u>FIGURE</u>	
4	1	TYPICAL GROUND FLOOR INSTALLATION – VMC COMPRESSORS WITH STRUCTURAL STEEL BASE
5	2	UPPER FLOOR INSTALLATION
7	3	TYPE “KIP-C” VIBRATION ISOLATORS
9	4	CONCRETE PAD FORM
12	5	SHEAVES AND BELTS
14	6	BELT ALIGNMENT
16	7	PIPING SCHEMATIC – TYPICAL OIL SEPARATOR INSTALLATION
17	8	TYPICAL CRANKCASE HANDHOLE COVER – 400 VMC COMPRESSOR MODEL SERIES
18	9	SHELL & TUBE OIL COOLER

<u>PAGE</u>	<u>TABLE</u>	
2	1	VILTER VMC COMPRESSOR DISPLACEMENT AND CONNECTIONS
3	2	VILTER VMC COMPRESSOR DIMENSIONS AND WEIGHTS
8	3	CRANKSHAFT REMOVAL CLEARANCES
11	4	DRIVE COUPLING PART NUMBER CROSS REFERENCE
19	5	STANDARD OIL COOLER APPLICATION
20	6	COMPRESSOR COOLING WATER FLOW RATES
25	7	COMPRESSOR CRANKCASE OIL CHARGE
29	8	OIL PRESSURE ADJUSTING VALVE LOCATIONS

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

I. INTRODUCTION

Proper installation of the refrigeration compressor and its accessories is one of the most important aspects of system design. By performing the procedures in the following sections, you assure the optimum performance and efficiency of your Vilter VMC® MultiCylinder Compressor.

II. DELIVERY

All VMC Compressors are thoroughly inspected and "run-in" by our factory to ensure all units are mechanically sound upon shipment. Since damage can occur during shipment, however, units should be thoroughly inspected upon arrival at the installation site. Immediately report any damage found to the transportation company and to your local Vilter representative or the Vilter Home Office.

III. LOCATING THE UNIT

Before anchoring the unit and connecting the refrigerant piping and electrical lines, there are several factors to consider.

A. Drains

Locate the unit near a floor drain. Since a considerable amount of water must be transported away when draining units with water cooled condensers (for repairs or seasonal shut-downs), a floor drain is important.

B. Ventilation

Proper ventilation is required for efficient operation. Heat generated by the compressor and its motor must be vented to avoid motor overheating and burn-out. If your Vilter VMC Compressor is installed in a large room that does not have abundant natural ventilation, mechanical ventilation is recommended.

Use a small unit cooler, in conjunction with inlet condenser water, where the fan operates when the compressor is running. Another possibility for units using an evaporative condenser, is to draw air for the evaporative condenser through the condenser room. Also, exhaust air from conditioned spaces is effectively utilized when passing it over the compressor and motor. The importance of adequate cooling cannot be over-emphasized. Motors that occasionally operate at more than nameplate rating have a shorter life if not sufficiently cooled.

For motors which operate within nameplate ratings, room temperatures can be a maximum of ten degrees greater than normal room temperature. Consult local codes for ventilation requirements.

C. Servicing Space

Provide adequate space around the unit for servicing and maintenance work. See Table 2 for overall dimensions. Clearances necessary for removing crankshafts are listed in Paragraph V.

IV. FOUNDATION

Vilter Manufacturing Corporation maintains the highest standards in the design and manufacture of its VMC Compressors. All rotating parts are balanced, and the weights of reciprocating parts calculated, to keep vibration to a minimum while the compressor is operating.

Some vibration will exist, however. Take precautions to prevent its transmission to the building structure, or noise problems may develop. Vibration is transmitted in two ways; through the base and foundation of the machine, and through the piping. The following detailed methods of installation insure a minimum of vibration transmission.

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VILTER MultiCylinder Compressor

TABLE 1. VILTER VMC COMPRESSOR DISPLACEMENT AND CONNECTIONS

MODEL	COMPRESSOR CYLINDER QUANTITY	DISPLACEMENT AT MAX RPM (CFM)	COMPRESSOR CONNECTIONS (LINE SIZE-INCHES)			
			R-717		HALOCARBON	
			SUCTION	DISCHARGE	SUCTION	DISCHARGE
320 SERIES	3	88	---	---	2 ⁵ / ₈ " (66.68 mm)	2 ¹ / ₈ " (53.98 mm)
	4	118	---	---	3 ¹ / ₈ " (79.38 mm)	2 ¹ / ₈ " (53.98 mm)
	5	147	---	---	3 ⁵ / ₈ " (92.08 mm)	2 ⁵ / ₈ " (66.68 mm)
	6	171	---	---	3 ⁵ / ₈ " (92.08 mm)	2 ⁵ / ₈ " (66.68)
	7	208	---	---	3 ⁵ / ₈ " (92.08 mm)	3 ¹ / ₈ " (79.38 mm)
	8	235	---	---	4 ¹ / ₈ " (104.78 mm)	3 ¹ / ₈ " (79.38 mm)
350 ES SERIES	3	121	---	---	2 ⁵ / ₈ " (66.68 mm)	2 ¹ / ₈ " (53.98 mm)
	4	161	---	---	3 ¹ / ₈ " (79.38 mm)	2 ¹ / ₈ " (53.98 mm)
	5	201	---	---	3 ⁵ / ₈ " (92.08 mm)	2 ⁵ / ₈ " (66.68 mm)
	6	242	---	---	3 ⁵ / ₈ " (92.08 mm)	2 ⁵ / ₈ " (66.68 mm)
	7	282	---	---	3 ⁵ / ₈ " (92.08 mm)	3 ¹ / ₈ " (79.38 mm)
	8	322	---	---	4 ¹ / ₈ " (104.78 mm)	3 ¹ / ₈ " (79.38 mm)
440 SERIES	2	78	2 ¹ / ₂ " (63.5 mm)	2" (50.8 mm)	2 ¹ / ₂ " (63.5 mm)	2" (50.8 mm)
	4	155	3" (76.2 mm)	2 ¹ / ₂ " (63.5 mm)	3" (76.2 mm)	2 ¹ / ₂ " (63.5 mm)
	6	232	4" (101.6 mm)	3" (76.2 mm)	4" (101.6 mm)	3" (76.2 mm)
	8	209	4" (101.6 mm)	3" (76.2 mm)	4" (101.6 mm)	3" (76.2 mm)
	12	464	5" (127 mm)	(2) 3" (76.2 mm)	5" (127 mm)	(2) 3" (76.2 mm)
	16	619	6" (152.4 mm)	(2) 3" (76.2 mm)	6" (152.4 mm)	(2) 3" (76.2 mm)
450 XL SERIES	2	99.5	2 ¹ / ₂ " (63.5 mm)	2" (50.8 mm)	2 ¹ / ₂ " (63.5 mm)	2" (60.8 mm)
	4	199	3" (76.2 mm)	2 ¹ / ₂ " (63.5 mm)	3" (76.2 mm)	2 ¹ / ₂ " (63.5 mm)
	6	298	4" (101.6 mm)	3" (76.2 mm)	4" (101.6 mm)	3" (76.2 mm)
	8	298	4" (101.6 mm)	3" (76.2 mm)	4" (101.6 mm)	3" (76.2 mm)
	12	597	5" (127 mm)	(2) 3" (76.2 mm)	5" (127 mm)	(2) 3" (76.2 mm)
	16	796	6" (152.4 mm)	(2) 3" (76.2 mm)	6" (152.4 mm)	(2) 3" (76.2 mm)

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VILTER MultiCylinder Compressor

TABLE 2. VILTER VMC COMPRESSOR DIMENSIONS AND WEIGHTS

MODEL	COMP CYL QTY	* OVERALL DIMENSIONS						** SHIPPING WEIGHTS		
		V-BELT DRIVE			DIRECT DRIVE			BARE COMP	UNIT WEIGHT	
		L	W	H	L	W	H		V-BELT DRIVE	DIRECT DRIVE
300 SERIES	3	66"	42"	34"	75"	33"	31"	965	1410	1310
	4	67"	42"	34"	76"	33"	31"	970	1425	1320
	5	67"	45"	36"	76"	33"	33"	1010	1495	1385
	6	67"	45"	36"	76"	33"	33"	1015	1500	1390
	7	67"	45"	36"	76"	33"	33"	1070	1575	1455
	8	68"	45"	36"	78"	33"	33"	1075	1595	1475
400 SERIES	2	69"	48"	50"	79"	41"	50"	1200	2000	1900
	4	74"	49"	52"	87"	42"	52"	1600	2500	2400
	6	76"	56"	40"	93"	43"	41"	1900	3000	2900
	8	76"	56"	39"	96"	45"	39"	2200	3400	3300
	12	83"	80"	59"	129"	51"	60"	3600	5000	5000
	16	84"	80"	63"	129"	51"	64"	4000	5500	5500
	6 (2-Stage)	89"	48"	64"	89"	55"	64"	2600	3500	3300
	12 (2-Stage)	104"	77"	63"	132"	49"	64"	4700	6100	6100

NOTES:

* Unit length in inches, unit length dependent on size and make of motor.

** Unit weight in pounds, motor and starter not included in unit weights.

A. Dimensions are approximate and not to be used for construction. Certified prints will be furnished for this purpose.

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VILTER MultiCylinder Compressor

A. Ground Floor Installation

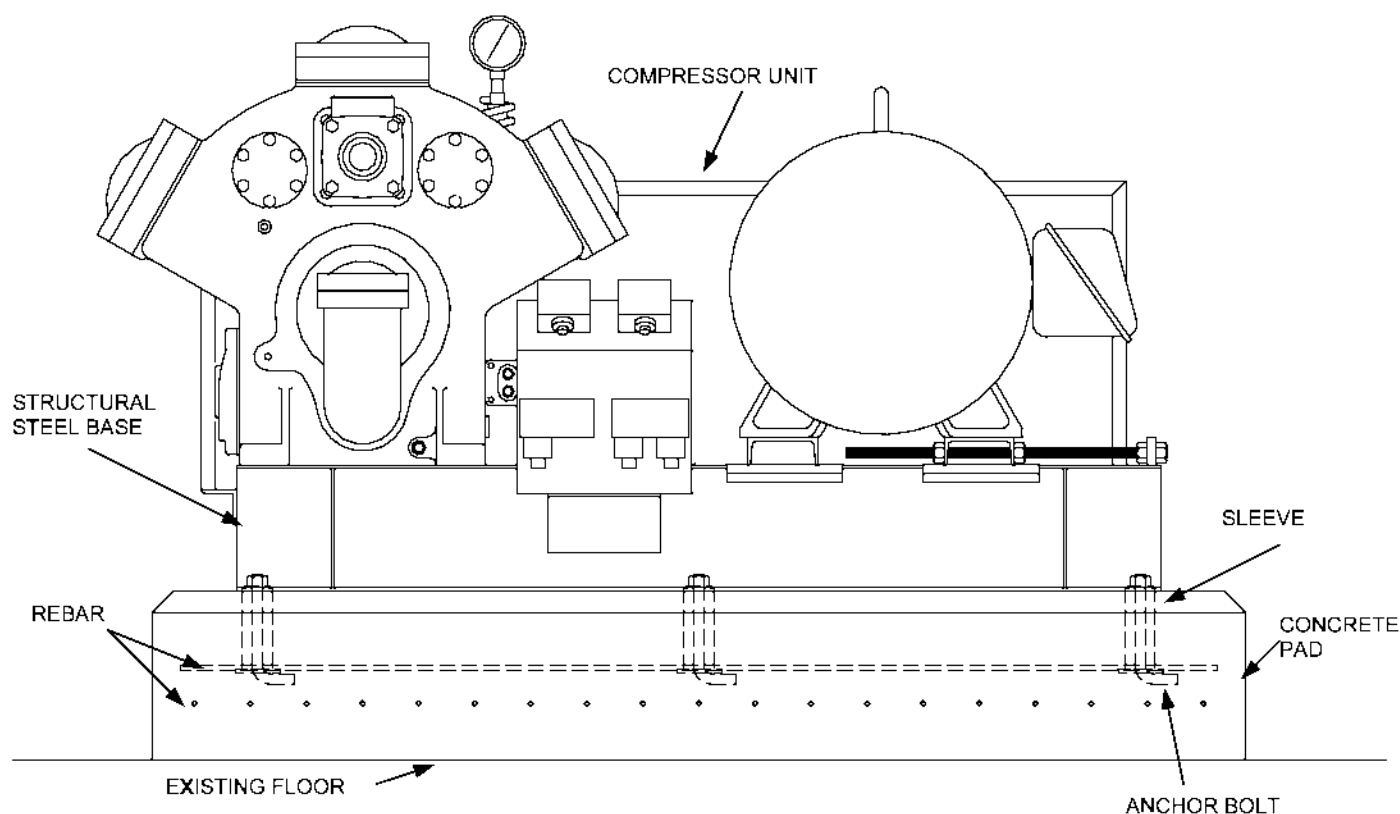
Vilter VMC Compressors are available with structural steel bases, or the customer may mount units on reinforced concrete foundations.

The installation, illustrated in Figure 1, is recommended for VMC's that include a steel base. The raised concrete pad allows efficient cleaning while providing a level position. Regardless of method used, the unit must be level.

When placing the foundation on an existing concrete slab, the surface must be rough, thoroughly clean, dry and free of oil. Foundation bolts are to be anchored into the concrete slab, and must line up with the bolt holes on the structural steel base. If the floor is not of sufficient thickness, or if the subsoil has not been sufficiently compacted, an inertia pad will be required to support the unit and dampen any vibration.

NOTE:

For even smoother operation, once base is mounted on a concrete pad, encase base in concrete.



**FIGURE 1. TYPICAL GROUND FLOOR INSTALLATION
VMC COMPRESSORS WITH STRUCTURAL STEEL BASE**

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VILTER MultiCylinder Compressor

B. Upper Floor Installation

Install only the 2 through 8-cylinder VMC Compressors on upper floors. Upper floor installations generally require using special vibration isolators to prevent transmission of the small residual vibration associated with machinery containing moving components to the building and to damp-out noise.

CAUTION

Three types of isolators are used – the first two types are used when mounting the structural steel base directly on isolators and the third when using a concrete pad along with the compressor unit. Follow proper adjustments for the type used.

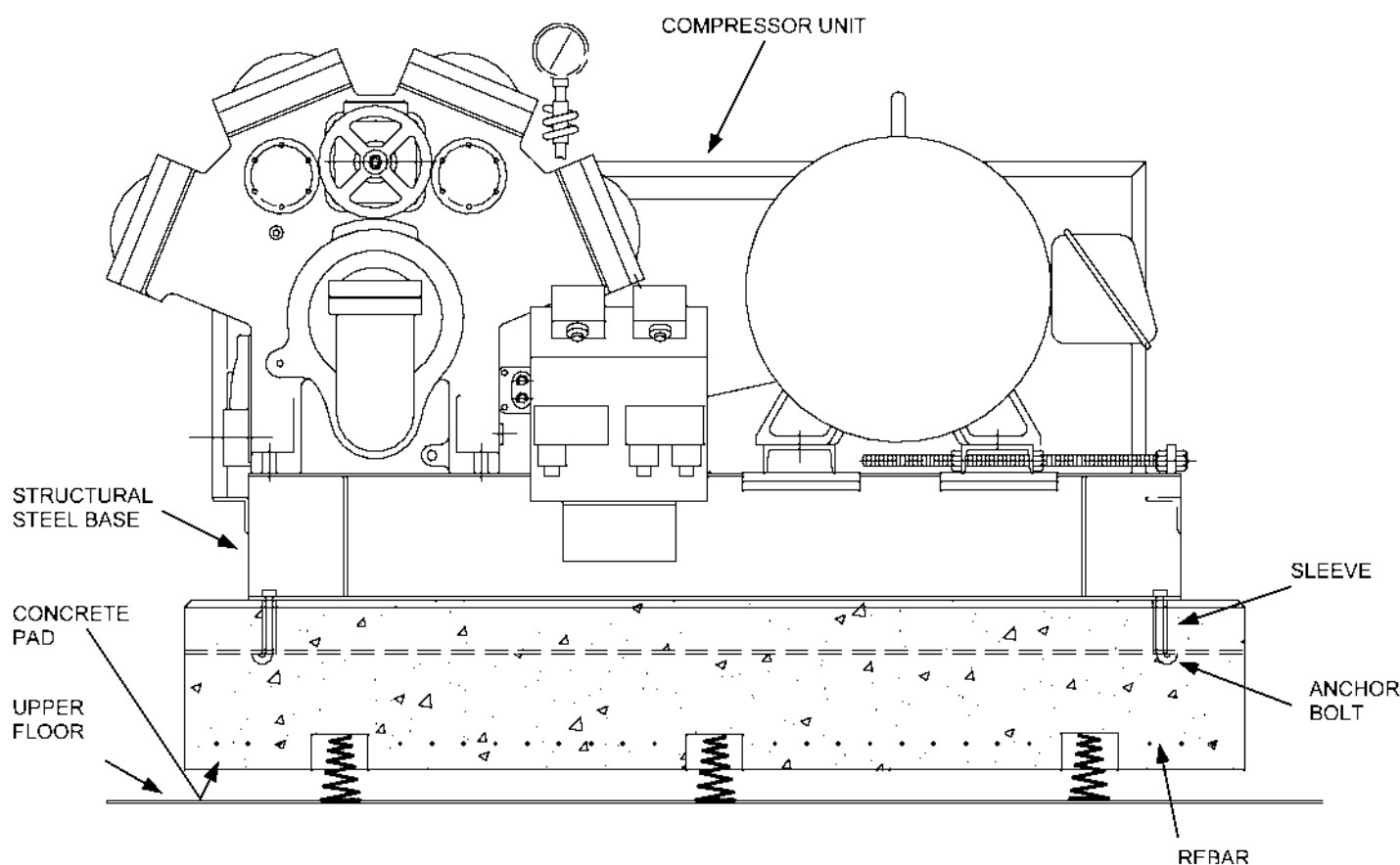


FIGURE 2. UPPER FLOOR INSTALLATION

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C. Upper Floor Installations (cont'd)

Regardless of the type of isolators used, the springs should never be compressed to the point of being solid. Level adjustment of $\frac{3}{4}$ " (19.05 mm) is provided. Isolators are shipped assembled with correct springs. All springs are color coded. Use color chart furnished with isolator for spring identification. Type "W" acoustical friction pads are provided on the bottom to eliminate the need for bolting down on most installations.

1. Type "FLS" Vibration Isolators

For ordinary commercial upper floor installations, the vibration can be absorbed adequately with type "FLS" vibration isolators. Such an installation, using only isolators, is accomplished by locating the bolt holes for the isolators, bolting the isolators down, making sure they are level and mounting the unit on the isolators.

2. Type "KIP-C" Vibration Isolators

For more critical upper floor installations, it may be necessary to increase the static mass to further reduce the vibration amplitude. Figure 2 illustrates a practical method of accomplishing this.

Instructions for installing and adjusting the type "KIP-C" vibration isolators are as follows:

- a) Place two layers of waterproof paper on sub-base where concrete foundation is to be poured.
- b) Construct foundation formwork. See Figure 4.
- c) Place "KIP-C" mount housings (without spring elements) within formwork in accordance with foundation plan.
- d) Drive nails through V-slots provided in "KIP-C" housings into formwork to keep housings in place.
- e) Lay the necessary reinforcing steel in place within the formwork and locate anchor bolts for the equipment as required.
- f) Pour concrete foundation, compacting thoroughly. Concrete is 137 lbs. per cu.ft. Concrete should be, at least, equal weight of the unit. In a 9" (228.6 mm) high base, pour concrete in until the height is at least $4\frac{1}{2}$ " (114.3 mm).
- g) After foundation has set and cured, and formwork removed, set equipment in place on foundation.
- h) Insert spring assemblies in place in "KIP-C" housings, checking carefully that assembly of proper capacity is set in each location. Spring assemblies can be identified by designation stamped on nameplate and/or color code.
- i) Center spring assembly under the washer in the top of the housing, and turn up adjustment bolt by hand until it seats within washer.
- j) With wrench, take four complete turns, counterclockwise, on adjusting bolt of each mount. Repeat this procedure three additional times, making a total of sixteen turns on each bolt. Take additional turns as required to raise foundation $\frac{3}{4}$ " (19.05 mm) of sub-base.
- k) Level foundation by taking additional turns on bolts of mounts at low side of corner.
- l) If equipment requires extensive piping connections, it may be desirable to stabilize the foundation by inserting shims underneath while the piping work is done.
- m) Piping should be independently supported, and brought to the equipment so pipe load is not placed on foundation.
- n) After piping and electrical connections are made, shims may be knocked out and the equipment operated.

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VILTER MultiCylinder Compressor

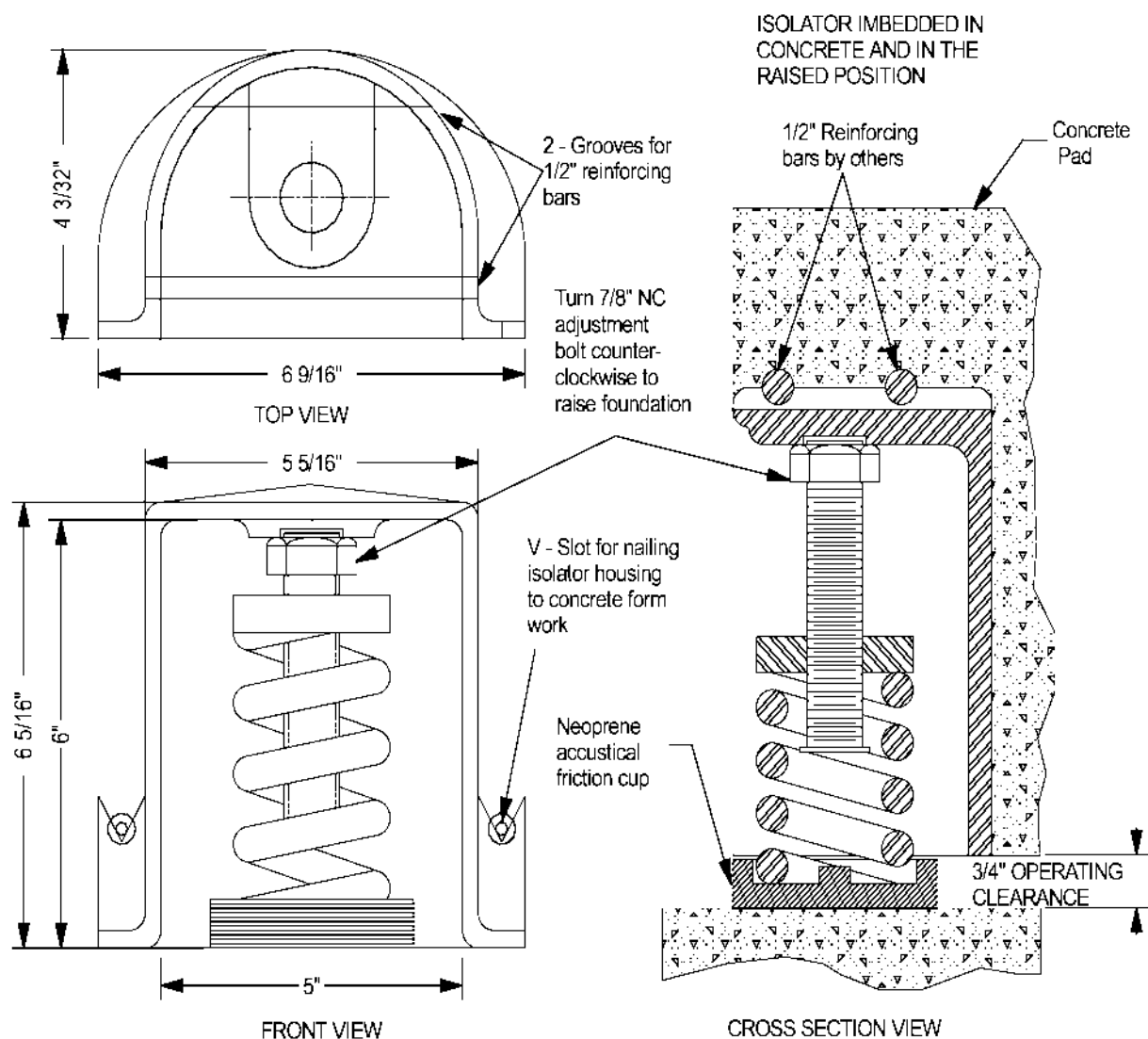


FIGURE 3. TYPE "KIP-C" VIBRATION ISOLATORS

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V. FORMS AND TEMPLATES

Prints showing foundation layouts are included with each unit. When locating the foundation, remember to allow adequate space for servicing the compressor and removing the crankshaft. Consult Table 2 for overall dimensions. Crankshaft minimum allowances for the various machines are given in Table 3. These are minimum clearances in inches (millimeters) to remove crankshafts, measured from compressor frames.

TABLE 3. CRANKSHAFT REMOVAL CLEARANCES

COMPRESSOR SIZE (cyl. qty.)	MODEL 300 SERIES		MODEL 400 SERIES	
	DRIVE END	PUMP END	DRIVE END	PUMP END
3 thru 8	30" 762 mm	30" 762 mm	---	---
2 thru 8	---	---	30" 762 mm	22" 558.8 mm
12 & 16	---	---	60" 1524 mm	52" 1320.8 mm

Use a form similar to that in Figure 4 to construct the concrete pad. Construct this form to withstand the weight of wet concrete. In addition, nail a 1" (25.4 mm) beveled strip around the top edge of the form to eliminate a sharp corner at the top of the pad.

Make the templates for locating the structural steel base anchor bolts from 1" (25.4 mm) to 6" (152.4 mm) boards. Accurately locate holes in the templates, and nail templates in place. Insert the anchor bolts with sleeves on them in the holes. Screw down the nuts until the sleeve is drawn up against the template.

Make this sleeve from a light weight metal shaped cylinder, to a diameter three times that of the anchor bolt. Place a washer of the same material at the bottom of the sleeve.

VI. CONSTRUCTION OF REINFORCED CONCRETE PAD

To construct a reinforced pad, place reinforcing steel rods in the concrete pad while it is being poured. Place layers of steel rods 6" (152.4

mm) apart with individual rods placed at a minimum of 6" (152.4 mm) from center to center. Position the layers in the pad to give a crosshatch effect (i.e. one layer placed lengthwise, the next crosswise, and so on). Keep the rod length about one inch less than the inside dimension of the form, so it is laid in place quickly and easily. To facilitate even spacing and quick placement, wire the rods together at 6" (152.4 mm) intervals using 6x6 wire mesh. There are variations for any given installation, but in all cases, the weight of the concrete pad should equal or exceed the weight of the compressor and drive. See Table 2 for approximate unit weights.

Extend the pad at least 6" (152.4 mm) beyond the outside of the structural steel base, and at least 12" (304.8 mm) deep. Use base dimensions furnished with each compressor to locate all pad anchor bolts.

When constructing a concrete pad including vibration isolators, remember the form must be constructed and the concrete pad poured on a sub-base over which two layers of waterproof paper are placed. This is so the pad is raised off the sub-base by isolators.

VII. CONCRETE

It is recommended the base be filled with concrete to increase vibration dampening.

The unit base must be grouted in place. Grouting ensures good contact between the base and foundation, allowing the foundation to stiffen the base as well as dampen any vibratory forces. The grout for filling the sleeves and leveling must be expanding grout rather than shrinking to provide a tighter bond.

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TEMPLATE FOR BASE ANCHOR BOLTS

TOP OF FORM MUST BE LEVEL
WHEN CONCRETE IS POURED

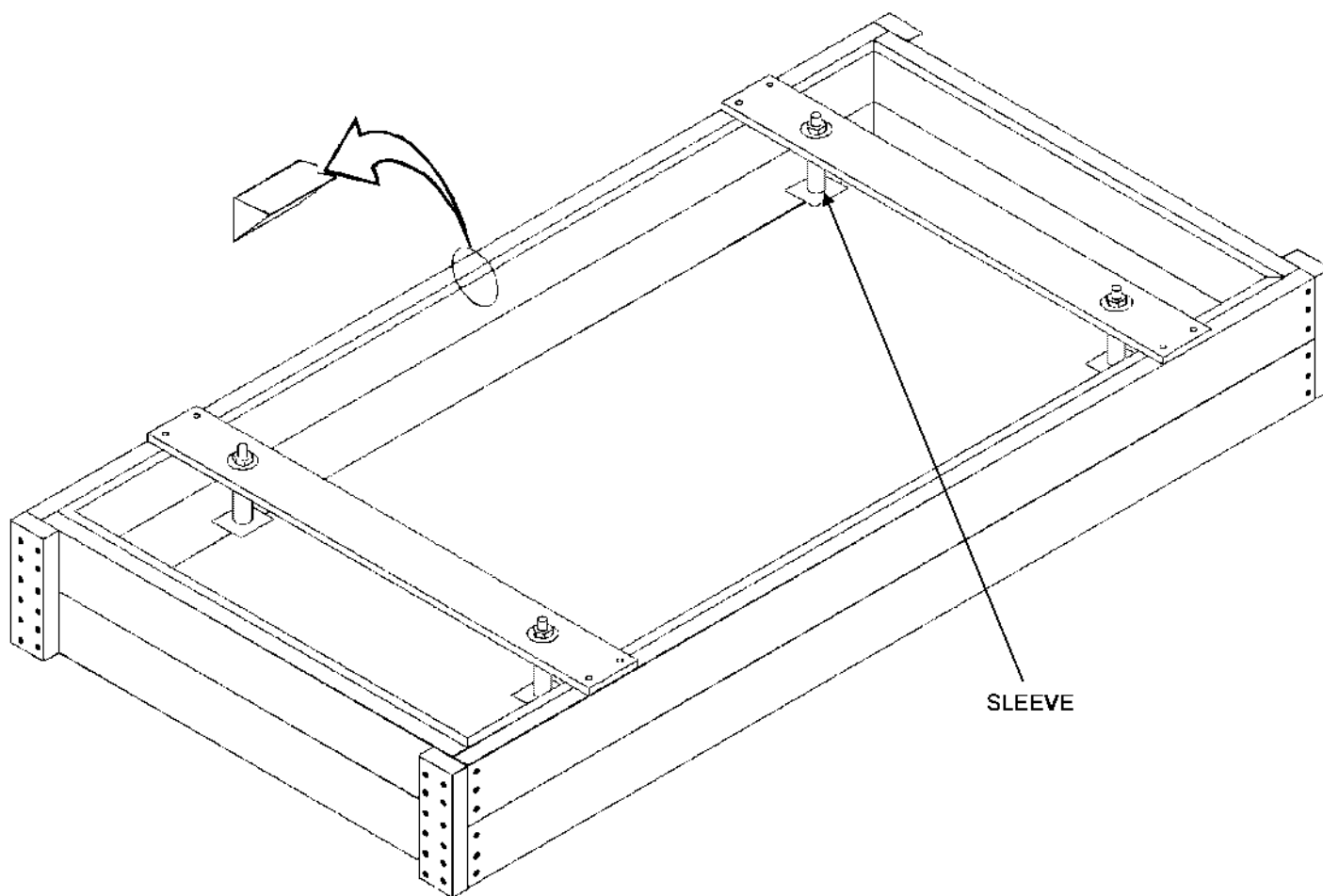


FIGURE 4. CONCRETE PAD FORM

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VIII. SETTING AND LEVELING UNIT ON CONCRETE PAD

Immediately before the compressor is set on the concrete pad, fill the sleeves on the anchor bolts with grouting. In this way, the anchor bolts may be moved slightly, permitting final alignment with the base holes while eliminating the difficulty of filling the sleeves after the unit is in place.

When the compressor unit is placed on the concrete pad, check both lengthwise and crosswise to assure it is level. Use shims and wedges under the steel base to adjust the level of the unit if it is not satisfactory. Once the unit is perfectly level, it should be grouted in with a suitable tool for working the grouting into hard-to-get-at places.

Allow the grouting to harden completely, then tighten the anchor bolts. Recheck the unit alignment to insure its position has not changed.

XIV. DIRECT CONNECTED DRIVEN COMPRESSOR UNIT

CAUTION IMPORTANT PRE-START OPERATION NOTICE

The drive coupling installed on your compressor is NOT completely aligned. DO NOT attempt to run unit until proper motor-coupling-compressor alignment is attained. Misalignment beyond specified limits causes excessive vibrations and premature failure of bearings, coupling and seal.

The same care in installing and aligning the flexible coupling used on direct connected VMC Compressors should be exercised when installing a rigid flange coupling. To correctly install and align the coupling, see the insert of manufacturer's procedures. The Thomas Coupling

Division type number must be known in order to use these aligning instructions. Some couplings are only identified with a Vilter part number. In those cases, use cross reference Table 3 to find the corresponding Thomas type number.

See Figure 5 for recommended direction of compressor rotation.

X. V-BELT COMPRESSOR UNIT

VMC Compressors equipped with "5V" V-belt drives are designed to meet necessary horsepower requirements. They are furnished as a matched set of individual V-belts, or optionally (at added cost), as a banded (joined) unitbelt.

The V-belt is one of the simplest and most dependable methods of transmitting power from one machine to another. The drive, when properly installed, is quiet, relatively smooth operating, and practically maintenance free. Use of the correct tension in any V-belt drive is necessary to obtain the maximum service and capacity from the drive. Excessive tension will greatly decrease the service life of the V-belts while insufficient tension will not allow the V-belts to transmit maximum load.

CAUTION

Because equipment alignment could be disrupted during shipment, check drive alignment before start-up. Always follow proper V-belt tensioning procedures. See V-belt drive tag furnished with equipment.

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TABLE 4. DRIVE COUPLING PART NUMBER CROSS REFERENCE

THOMAS COUPLING DIVISION TYPE	VILTER PART NUMBER				
	TAPER BORE HUB (COMPRESSOR)		CENTER MEMBER ASSEMBLY	STRAIGHT BORE HUB (MOTOR)	
	BORE DIMENSIONS (LARGE END)	PART NUMBER		BORE DIMENSIONS	PART NUMBER
201 DBZ-B	1.883" / 47.8 mm	1890A	1891A	1.375" / 34.9 mm 1.625" / 41.3 mm 1.875" / 47.6 mm Pilot hole	1896A 1896B 1896C 1896D
226 DBZ-B	1.883" / 47.8 mm	1890B	1891B	1.875" / 47.6 mm 2.125" / 54 mm 2.375" / 60.3 mm Pilot hole	1896E 1896F 1896G 1896H
262 AMR	1.992" / 50.6 mm	1890C	1891C	1.875" / 47.6 mm 2.125" / 54 mm 2.375" / 60.3 mm Pilot hole	1896J 1896K 1896L 1896M
312 AMR	1.992" / 50.6 mm 2.484" / 63.09 mm 2.984" / 75.79 mm	1890D 1890E 1890F	1891D	2.125" / 54 mm 2.375" / 60.3 mm 2.875" / 73 mm Pilot hole	1896N 1896P 1896Q 1896R
350 AMR	1.992" / 50.6 mm 2.492" / 63.3 mm 2.992" / 76 mm	1890G 1890H 1890J	1891F	2.125" / 54 mm 2.375" / 60.3 mm 2.875" / 73 mm Pilot hole	1896S 1896T 1896U 1896V
375 AMR	2.492" / 63.3 mm 2.992" / 76 mm	1890K 1890L	1891F	2.375" / 60.3 mm 2.875" / 73 mm 2.375" / 60.3 mm Pilot hole	1896W 1896X 1896Y 1896Z

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

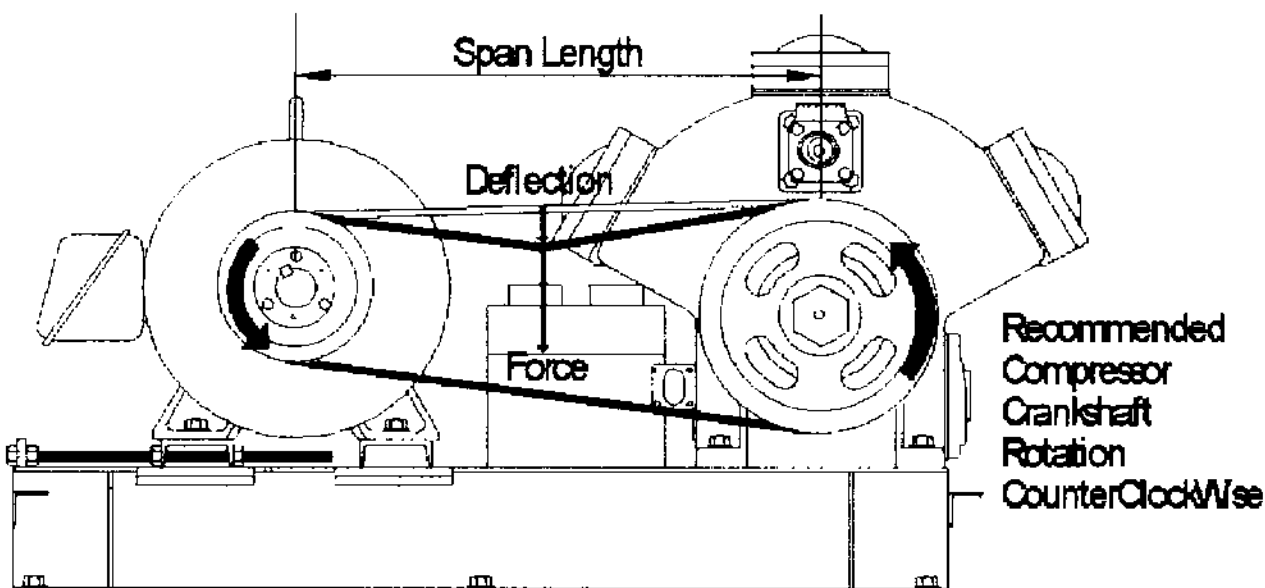


FIGURE 5. SHEAVES AND BELTS

A. V-Belt Installation

The motor of the V-belt driven compressor is mounted on a slide rail that enables movement of the motor toward or away from the compressor by loosening four adjusting screw lock nuts, eight guide clamp bolts and nuts, and turning the two adjustment screws. The proper method of installing V-belts is as follows:

1. Move the sheaves toward each other to each V-belt installation.

NOTE:

Mount the motor sheave as close as possible to the motor housing. Keeping the V-belt pull as close to the motor and compressor as possible gives the most rigid mounting, minimizing V-belt flopping.

2. Work V-belts around the sheaves by hand. On drives having more V-belt grooves in the sheaves than needed, use grooves closest to the motor and compressor. Make sure the V-belts are all slack on the same side of the drive, preferably the bottom. Drive should pull tight across the top of the flywheel. Never mix slack and tight sides as this could cause serious damage to the V-belts when tightening the drive. Never pry or "roll" V-belts onto the sheaves. This can cause serious tearing and damage to the V-belts.
3. Move the sheaves apart until the V-belts are snug.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

A. V-Belt Installation (cont'd)

4. The motor rails should be perpendicular to the base. Check compressor for soft foot and shim accordingly.
5. Check the motor and compressor shafts to make sure they are parallel. Check the flywheel and motor sheave with a straight edge, string, or wire to be sure they are parallel, and in the same plane. See Figure 6. Fix any misalignment by moving the motor by means of adjusting screws.
6. Recheck drive and tension. Adjust, if necessary, after 2 to 4 hours and again after 24 to 48 hours of operation to compensate for initial stretch and wearing of the V-belts.
7. Make periodic checks of drive tension. Speed ratio and tension should be restored as necessary. The change in speed ratio from no load to full load should not exceed 1%.
8. Save used V-belts for emergency replacement, but never mix new and used V-belts on a drive.
9. Keep V-belts as free of dirt and oil as possible. Never paint V-grooves on flywheel or sheave.
10. Never use V-belt dressing on V-belts.

B. V-Belt Adjustment – General Comments

Tension usually is not critical, but a few simple rules satisfy most requirements.

- ☒ Best tension for a V-belt drive is the lowest tension at which the V-belts will not slip under the highest load condition.
- ☒ Check tension frequently during the first day of operation.
- ☒ Too much tension shortens V-belt and bearing life.

- ☒ Keep V-belts and sheaves free of any foreign material, which may cause slip.
- ☒ If a V-belt slips, determine the cause for slippage and take corrective action.

C. Single "5V" V-Belt Adjustment

The method of checking single V-belt tension using numerical values is as follows:

1. After proper V-belt installation, measure the span in inches.
2. Use a spring scale at right angles to the center of the span. Apply enough force to deflect the V-belt 1/64th of an inch for every inch of span length and record the scale reading. The range of force should be 12 to 18 lbs.
3. Make sure equal tension exists on all V-belts in a set. Correct original tensions, as needed, by shifting the motor slightly. This point is very important. For example, on a four V-belt set drive, tension readings of 14, 13, 13, and 12 (although the average is 13 pounds) indicate misalignment and probable trouble. Drive horsepower capability can be reduced by as much as 50% if uniform V-belt tension is not attained. V-belts could slip, pop out of grooves or roll over.
4. Run the compressor at full load in the recommended direction. This direction tends to tighten rather than loosen the front bearing lock nut. This is extremely important if the locking compound is accidentally omitted. Be certain V-belts are not slipping. The belts will not slip when the correct tension has been applied.
5. After operating 2 to 4 hours, retension the drive to the high side of the normal required tension.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

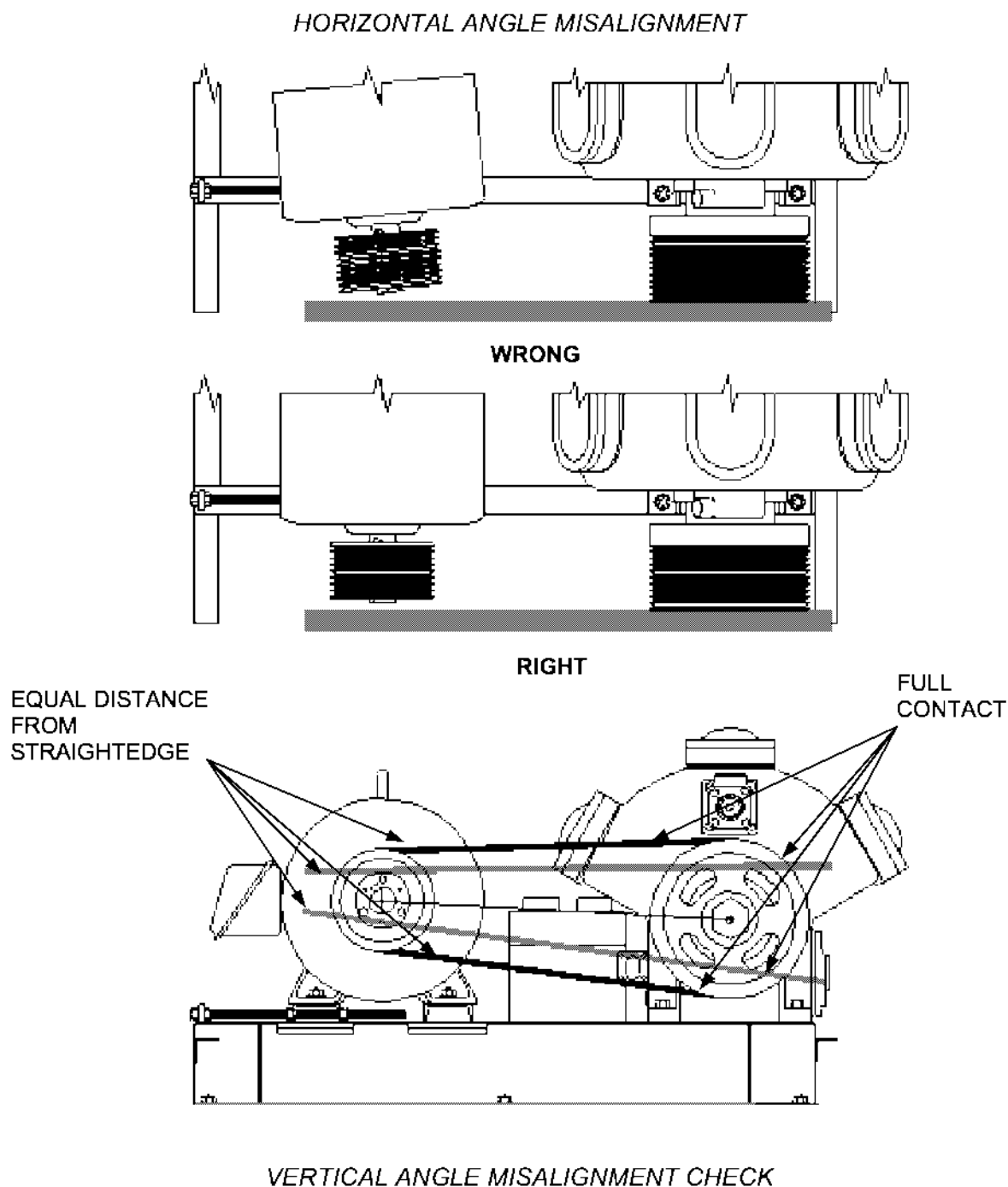


FIGURE 6. BELT ALIGNMENT

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

C. Single "5V" V-Belt Adjustment (cont'd)

6. It is recommended that belt tension be checked 24 to 48 hours after initial installation.
7. Recheck the motor and compressor shafts and sheaves for alignment. If shafts or sheaves are not in alignment, V-belts tend to turn over in the grooves and wear unnecessarily fast, leading to noise and loss of transmission efficiency.

NOTE:

Do not attempt to mix V-belts. Use only matched V-belts provided by manufacturers and always specify type and size of V-belts. Do not use uncoated belts.

D. Banded (Joined) "5V" V-Belt Adjustment

To check banded "5V" V-belt tension, use the following methods:

1. *Method "A"*

Multiply the pounds of deflection force of 12 to 18 pounds by the number of V-belts in the band. Apply the tension tester to deflect the entire band. Place a small board or metal plate on the top of the band so all v-belts in the band are deflected a uniform amount. Place a straightedge across the sheaves to use as a reference for measuring deflections.

2. *Method "B"*

Move the sheaves closer together to facilitate installation of banded V-belts. Remove slack from V-belts. Measure the outside circumference of V-belt to the nearest $\frac{1}{4}$ " (6.35 mm). Multiply this reading by 0.0075 to 0.01, and add this amount by your circumference length.

(Example: $80" \times 1\% = .8" + 80" = 80.8"$)

E. V-Belt Removal For Servicing

Whenever it is necessary to remove V-belts for equipment servicing, follow the installation procedure outlined for the initial tensioning of the V-belts, whenever the belts are reinstalled.

XI. ACCESSORIES AND ASSOCIATED EQUIPMENT

A. Oil Separator

1. General Description

The oil separators for VMC Compressors are either the demister pad standard oil separator or the flanged coalescing element Super Separator®.

Both styles of oil separators are mounted in the compressor discharge line. The standard style oil separator can only be mounted in the horizontal position. The Super Separator style oil separator can be mounted in vertical or horizontal positions.

NOTE:

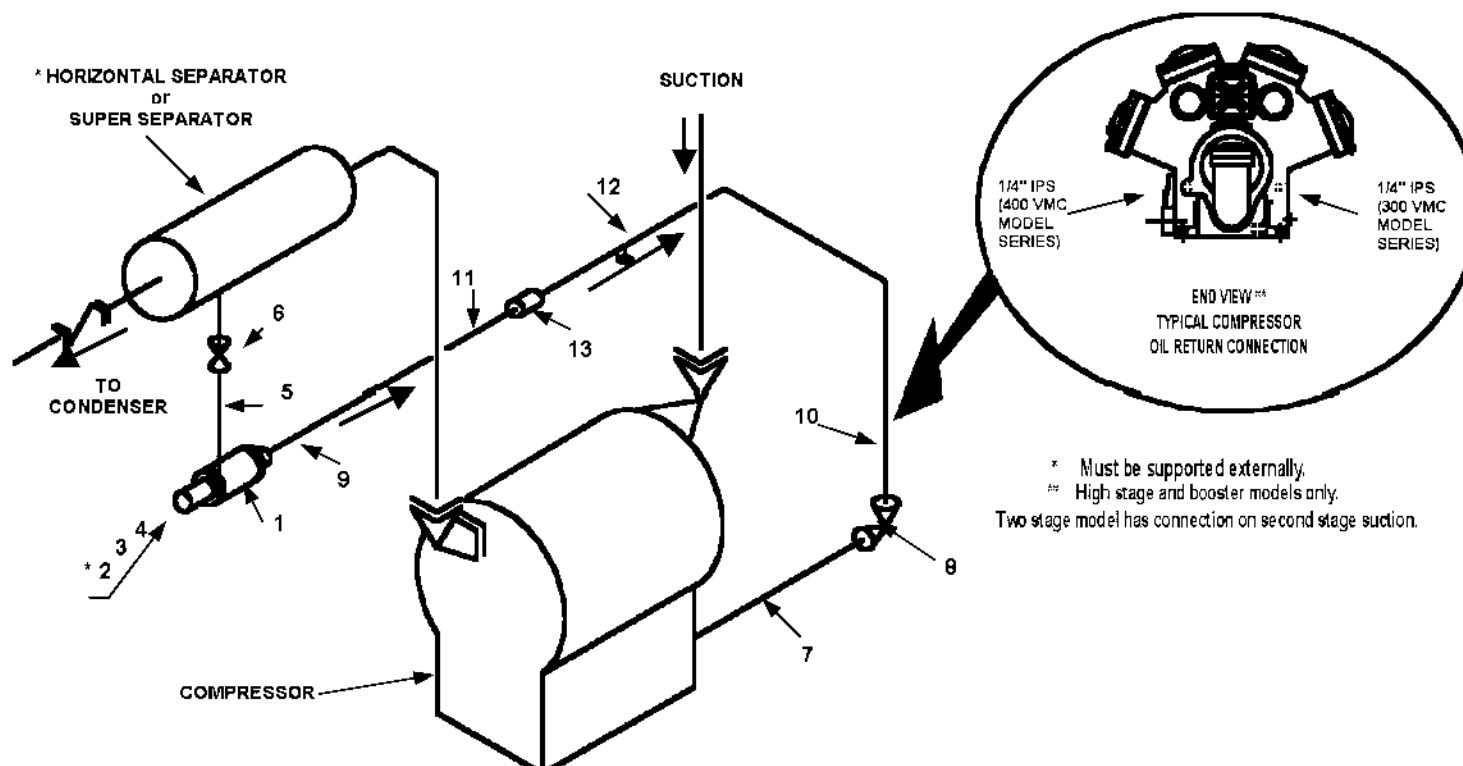
The separator should be installed with the flow in the direction of the arrow on the separator.

The separator and piping should be supported so no piping loads are transmitted through the compressor frame.

No initial oil charge is necessary for these separator types. Oil separators prevent oil from reaching the evaporator where it would impair efficiency. They are especially recommended for flooded systems, low temperature applications, and any other installation where oil return from the low side may not be positive.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor



	ITEM	DESCRIPTION	INSTALLATION KIT PART NO.
KEY	1.	External High Pressure Float Valve	KT1019 (Ammonia) Or KT1018 (Halocarbon)
	2. *	Float Chamber	
	3.	Inner Flange Gasket	
	4.	$\frac{3}{8}$ " x $1\frac{1}{4}$ " Cap Screws (Qty. Six)	
	5.	$\frac{1}{2}$ " x 3" lg. Sch. 160 Pipe Nipple	
	6.	$\frac{1}{2}$ " Standard Screw End Valve	
	7.	$\frac{1}{4}$ " x $2\frac{1}{2}$ " lg. Sch. 80 Pipe Nipple	KT1017 (Ammonia) Or KT1016 (Halocarbon)
	8.	$\frac{1}{4}$ " Angle Screw End Valve	
	9.	$\frac{1}{4}$ " O.D. x $\frac{1}{4}$ " FPT Compression Connector	
	10.	$\frac{1}{4}$ " O.D. x $\frac{1}{4}$ " MPT Compressor Connector	
	11.	$\frac{1}{4}$ " O.D. x 10 ft. Steel Tubing (Qty. Two)	
	12.	$\frac{1}{4}$ " O.D. Tubing Clips (Qty. Six)	
	13.	$\frac{1}{4}$ " O.D. x $\frac{1}{4}$ " O.D. Compression Union	

FIGURE 7. PIPING SCHEMATIC, TYPICAL OIL SEPARATOR INSTALLATION

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

A. Oil Separator

1. General Description (cont'd)

Vilter Horizontal Oil Separators are constructed for use with either steel pipe or copper tubing. The steel inlet and outlet connections are counterbored to form a socket so they will accept copper tubing.

Cut off the counterbored portion when using this oil separator with steel pipe. The wall thickness of the counterbored portion is too thin for the discharge pressure involved.

2. Oil Separator Float Valve

An external high pressure float valve is used in conjunction with the oil separator. A $\frac{1}{4}$ " (6.35 mm) line coming from the float valve returns oil to the compressor. On the 300 Series Compressors, oil is returned to the crankcase chamber on the drive end of the compressor. On the 400 Series Compressors, oil is returned to the crankcase chamber on the pump end of the compressor.

NOTE:

This float valve is designed to open when oil level in the float chamber rises. Make a visual check before installing in chamber. The word "TOP" is stamped on the outside of the float valve flange. Remove the tie wrap on float valve. This is used to transport the valve. The float valve must be installed in the chamber as indicated on the flange. Proper positioning at installation will ensure trouble free operation later.

Connect the float valve chamber and float valve to the separator with tubing. Use the support plate to hold the float valve chamber. **DO NOT** support the float valve chamber by the tubing or pipe along the separator or weld on the separator or float

valve chamber. The float valve outlet should be in the horizontal plane.

B. Crankcase Heater

Three types of crankcase heaters are available for use with all Vilter VMC Compressors. The first is a blanket heater cemented to the bottom of the compressor. It is primarily used in outdoor applications.

The second type is an immersion type heater. It is mounted in the crankcase handhole cover (on 400 Series VMC Compressors only). These heaters keep the crankcase and oil warm during the "off" cycle, preventing refrigerant from condensing. When refrigerant condenses in oil during the "off" cycle, lubrication problems and "nuisance" oil failures are possible. The crankcase heater prevents this in most cases.

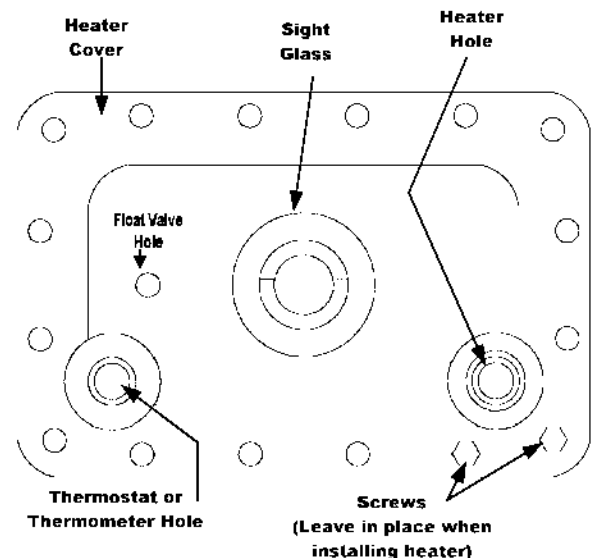


FIGURE 8. TYPICAL CRANKCASE HAND-HOLE COVER - 400 VMC COMPRESSOR MODEL SERIES

The third type is a cartridge type heater. It is mounted in the drive end of the frame on 300 Series VMC Compressors.

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VILTER MultiCylinder Compressor

C. Crankcase Heater (cont'd)

NOTE:

It is extremely important the heater be energized when the compressor is not operating, for compressors having a TRI-MICRO® filter without internal bypass. The heater is equipped with a non-adjustable internal thermostat set at 100°F (37.8°C).

When installing the heater, make electrical connections by removing the heater cover and inserting wires through the knock-out holes. Be sure the heater is on a separate circuit. **NEVER COMBINE WITH OTHER CONTROL CIRCUITS.**

To install or replace a crankcase heater on a 400 Series Compressor already in service, pump down the compressor as described in the Service Section.

If heater is to be replaced, use appropriate lockout and tag out procedures and electrically disconnect the heater before removing oil. The oil drain valve at the lower end of the compressor should be opened and the oil allowed to drain out completely. Next (only on 400 Series VMC Compressors), remove the handhole cover and substitute with a cover having a drilled and tapped hole for the heater.

Place the cover in a vise, making sure the two screws below the heater are left in place. If this is not done, the two screws can not be reinserted into the holes due to interference of the installed heater. Insert the heater element through a tapped hole and tighten the fitting.

Position the heater so the electrical connections are in the correct orientation. Connect wires as explained previously, and replace the handhole cover.

Refill the crankcase with oil and return the compressor to service. The 300 Series Compressor crankcase with factory installed heater is installed in a well on the drive side of the

compressor. It is not necessary to pump the compressor down and remove the oil to change the cartridge heater.

D. Oil Cooler

1. Introduction

Multipass shell and tube oil coolers are furnished on many VMC Compressors, and are mounted at the pump end. Oil coolers prevent excess thinning of oil during operation, and decrease oil consumption. Cooler oil oxidizes less, reducing sludge deposits in the compressor.

Oil from the compressor pump enters the cooler, then the TRI-MICRO filter. Water enters on the tube side. It flows through the cooler, and is expelled to a drain or condenser sump.

NOTE:

Water circuit through oil cooler and water cooled heads is in parallel. See "Operation" section.

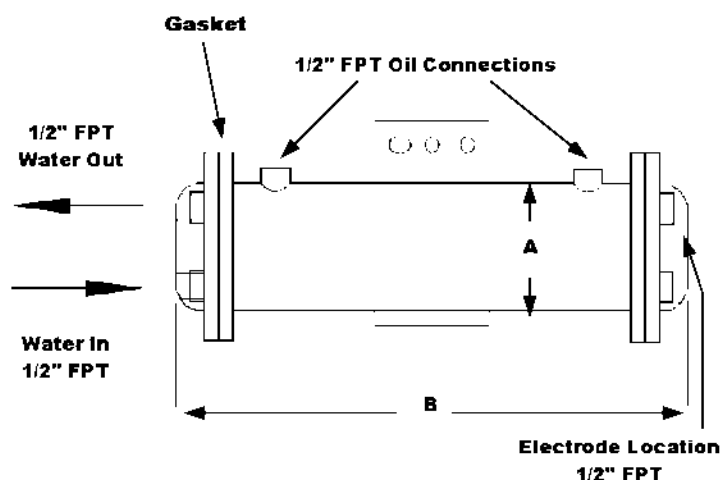


FIGURE 9. SHELL & TUBE OIL COOLER

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VILTER MultiCylinder Compressor

1. Introduction (cont'd)

TABLE 5. STANDARD OIL COOLER APPLICATION

QUANTITY OF CYLINDERS	OIL COOLER NOMINAL OVERALL DIMENSIONS	
	"A"	"B"
3 thru 8 300 SERIES	3" 76.2 mm	20" 508 mm
2 and 16 400 SERIES	- - -	20" 508 mm

2. Installation

- a) **Strainers and Filter:**
Vilter recommends the use of strainers when foreign matter is present in the water. Certain types of service require suitable filters to maintain standard efficiency.
- b) **Piping Layouts:**
All water piping leading into the oil cooler should be of sufficient size to assure an adequate supply of water.
- c) **Zinc Electrodes:**
All coolers designed for marine service are provided with one or more zinc electrodes. Make sure all required electrodes are installed in the oil cooler prior to placing in service.
- d) **Prevention of Gasket Leaks:**
Check all bolts for tightness before installing any oil cooler. Use caution when tightening bolts to prevent gasket surface damage.

3. Operating Pressure

All Vilter shell and tube oil coolers are designed for 300 psig (2068.44 kPa) on both the oil and water sides.

4. Inspection

Because water contains a variety of chemicals in solution, and the water side of the cooler is continually exposed to those chemicals, inspect the condition of the

tubes frequently. Inspect the tube side for any evidence of corrosion, scaling or other fouling. If there is evidence of these problems, take steps to correct them immediately.

NOTE:

Because Vilter has no control over field conditions of cooling water, Vilter cannot assume liability for damage to the compressor or the system due to problems arising from corrosion, scaling or fouling.

5. Service

- a) **Temperature Control:**
The function of the oil cooler is to maintain specified oil temperatures. When the temperature of the oil rises above normal, it is an indication some part of the temperature control system is not functioning properly, or a system or mechanical problem in the compressor. Inspect all manual and automatic control valves in the system for correct operation. Check all pressure gauges and thermostats. Inspect the water level to make sure proper flow through the cooler has been provided. Clean all strainers.
- b) **Disassembly and Cleaning:**
If the temperature does not return to normal after adjustments are made, and the specified amount of cooling water is circulating through the tubes, inspect the cooler for foreign deposits.

When materials accumulate in the cooler, cooling efficiency is impaired. Those materials should be removed. Remove all foreign substances from inside heads. Clean all gasket surfaces and install new gaskets wherever necessary. The type and condition of the water used and the operating conditions determine the cleaning periods. Using strainers in water lines extends the period between cleanings.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

b) Disassembly and Cleaning: (cont'd)

NOTE:

The concentration of chemicals and temperature varies in sea water, and consequently, the disintegration of zinc electrodes will be more rapid under some conditions. This is especially true where water is warm. It is important zinc electrodes are inspected once every thirty days. The condition of the zinc electrodes at the time of inspection should govern the policy for future servicing. If zinc electrodes are corroded and coated with foreign material, electrode effectiveness is either retarded or greatly reduced. Clean electrodes by wire brushing and scraping. If, after cleaning, zinc electrodes are more than 50% disintegrated, they must be replaced. Make certain zinc electrodes are tightened to ensure good metal contact.

E. Water Cooled Cylinder Covers

Water cooled cylinder covers are furnished for some models of Vilter VMC Compressors. They are mounted on top of the standard cylinder covers. Maintain an adequate supply of water to the water cooled covers in order to prevent minerals in the water from depositing in the covers and causing early fouling. When water is 80°F (26.7°C) or lower, the recommended quantity is 2½ to 4 GPM (0.16 to 0.25 l/sec) for 2 thru 8 cylinder machines and 5 to 8 GPM (0.32 to 0.51 l/sec) for 12 and 16 cylinder machines, depending upon discharge temperature. (The 12 and 16 cylinder machine connections are actually 2, 6 or 8 cylinder systems in parallel.) Table 6 shows the pressure drops through the cylinder covers for the recommended minimum and maximum flow rates.

If the necessary water pressure is not available, water connections should be configured in parallel and the quantity of water increased proportionally. A ½" (12.7 mm) thermostatic water regulating valve should be provided in the inlet to control water flow and connect the outlet to an open drain or condenser sump.

TABLE 6. COMPRESSOR COOLING WATER FLOW RATES

COMP SIZE	MAXIMUM		MINIMUM	
	GPM	PD *	GPM	PD *
2 CYL	4 0.25 l/sec	2.5 psi 17.2 kPa	2 ½ 0.16 l/sec	1.3 psi 9 kPa
3 & 4 CYL	4 0.25 l/sec	5 psi 34.5 kPa	2 ½ 0.16 l/sec	2.5 psi 17.2 kPa
5 & 6 CYL	4 0.25 l/sec	7.5 psi 51.7 kPa	2 ½ 0.16 l/sec	3.8 psi 26.2 kPa
7 & 8 CYL	4 0.25 l/sec	10 psi 68.9 kPa	2 ½ 0.16 l/sec	6 psi 34.5 kPa
12 CYL	8 0.50 l/sec	7.5 psi 51.7 kPa	5 0.32 l/sec	3.8 psi 26.2 kPa
16 CYL	8 0.50 l/sec	10 psi 68.9 kPa	5 0.32 l/sec	5.0 psi 3.8 kPa

* Pressure Drop

A provision should be made to shut off the water when the machine is stopped. The most positive way is to connect a solenoid water valve between the regulating valve and the jacket inlet with electrical connections made so the solenoid is open when the compressor is running and closed when the compressor stops.

Regulate the water quantity to maintain a temperature of 100°F (37.8°C) off cylinder covers.

CAUTION

To avoid condensation of refrigerant in the compressor, turn off water flow through the heads during compressor shutdown.

NOTE:

In order to further minimize the possibility of condensation, water flow through the cylinder cover is routed through the loaded cylinder banks first. This inlet to the loaded heads will always be on the side opposite the crankcase handhole cover.

F. Water Regulating Valve

A wide variety of water regulating valves are available for use with water cooled condensers. They maintain a constant condensing pressure and prevent waste of water.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

F. Water Regulating Valve (cont'd)

Water regulating valves are installed at the water inlet of the condenser. There is a small capillary tube running from the valve to the discharge line of the compressor, the hot gas line, or the top of the condenser. When the pressure builds up on the high side of the system, it is transmitted through this capillary to the valve. This acts against a spring, holding the valve closed.

Spring tension can be varied by means of an adjusting screw on the valve. When the valve is adjusted properly, it automatically opens and closes in response to the pressure on the high side of the system, maintaining a constant condensing pressure.

When cooling towers are used and no other positive means of regulating head pressure is provided, a water pressure regulating valve serves to regulate head pressure. Adequate head pressure is often important to provide proper refrigerant flow through expansion valves or float valves in order to maintain the suction pressure above the setting of the low pressure cut-out to prevent short cycling.

XII. SAFETY DEVICES

Plant safety requirements vary according to local ordinances. Research local codes before construction begins. In addition to devices for refrigerant control, safety devices are required for belt (full guards) and electrical equipment. (When required, a totally enclosed belt guard is available for VMC Compressors.)

NOTE:

Make all arrangements for installation of electric power and inspection services by local authorities prior to construction, so all work is performed before the compressor trial run.

XIII. ELECTRICAL EQUIPMENT AND SPECIFICATIONS

Electric solenoid valves for liquid and solenoid lines used in automatic refrigeration systems should always be mounted outside of the refrigerated room, if possible, in all installations. If it is impossible to mount the electric valves outside the low temperature room, mount the valves so no moisture drips into them during defrosting periods or any other time. In fresh produce or banana storage rooms, considerable moisture is always present in the air. Under no circumstances should electrical equipment be mounted in the room or difficulties will be experienced within a short time in electrical wiring as well as control devices.

Mount thermostats outside of the refrigerated room. Only the remote bulb of the temperature controller is in the refrigerated space.

For proper electrical connections, color code all control circuits. All wires common to the same control wire, starting from the motor starter, should be the same color. Where a temperature difference exists between various rooms in which the electric wiring is run, make provision for sealing off the conduits between such rooms. This is necessary to prevent condensation forming in the lower temperature room.

Connect control devices, such as electric valves, pressure switches, and thermostats with flexible conduit or "BX" armored cable, according to local electrical code. These flexible connections permit the device removal with no difficulty. Locate these devices with sufficient head room to permit removal from the piping lines.

The wiring diagram shown in this manual is only a typical schematic. It is necessary for the electrical contractor to make additions as required for construction purposes when meeting local code requirements.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

XIV. TESTING REFRIGERATION SYSTEM FOR LEAKS

Before proceeding with testing the system for leaks or evacuation of the system, please review all local laws and ordinances for information on the specific refrigerant used.

Vilter equipment is factory tested for leaks. After the equipment is leak-free, the unit is charged slightly above atmospheric pressure with a holding charge of nitrogen. This prevents impurities from entering the equipment during shipment. Upon receipt of the equipment, thoroughly check to see if a leak has developed. If a leak has developed, it should be repaired, tested, evacuated, and charged as described on the following pages.

One of the most important steps in installing a refrigeration system is testing for leaks. Testing ensures a tight system which will operate without loss of refrigerant. To test for leaks, pressurize the system. Do not use the compressor to build pressure as the compressor is not designed to pump air. Serious overheating and damage could result.

Test pressures for various refrigerants are listed in ASHRAE Standard 15 Code brochure entitled "Safety Code For Mechanical Refrigeration". These pressures usually suffice. Research local codes and ordinances before testing begins.

Determine the system tolerances for safety devices and relief valves. If the test pressure exceeds system tolerances, then remove valves and the appropriate devices:

- ☒ Plug all connections.
- ☒ All valves should be open except those leading to the atmosphere.
- ☒ Manually open all solenoids and pressure regulators.
- ☒ Open all bypass devices and proceed with testing.

Because of differences in characteristics of various refrigerants, two different testing methods are necessary.

A. Ammonia Systems

Dry nitrogen may be used to raise the pressure in an ammonia system to the proper level for the test. The gas may be put into the system through the charging valve or any other suitable opening.

Carbon Dioxide should **NOT** be used as a testing gas in a system in which ammonia is already dissolved in any moisture remaining. This will cause ammonium carbonate to precipitate when the CO₂ is added. If heavy enough, this precipitate may cause the machine to freeze and clog the strainers.

A mixture of four parts water to one part liquid soap, with a few drops of glycerin added, makes a good testing solution. Apply this mixture with a one inch round brush at all flanges, threaded joints, and welds. Repair all visible leaks. If possible, leave the pressure on over night. A small pressure drop of 5 lbs. over this period indicates a very tight system. Remember to note the ambient temperature as a change in temperature will cause a change in pressure.

After the system is thoroughly tested, open all valves on the lowest part of the system and arrange to carry the gas away from the compressor, so dirt or foreign particles cannot enter the working parts. The oil should then be charged into the compressor as described in Paragraph XVI of this section.

Charge a small amount of ammonia into the system. Pass a lit sulfur stick around all joints and connections. Any leaks will be indicated by a heavy cloud of smoke. If any leaks are observed during this test, they must be repaired and rechecked before the system can be considered tight and ready for evacuation.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

B. Other Refrigerant Systems

Dry nitrogen may be used to raise the pressure to the proper level for testing.

When the proper pressure is attained, use a one inch round brush and test for leaks with a mixture of four parts water and one part liquid soap with a few drops of glycerin added. Apply to all flanges, threaded, soldered, or welded joints. Observe all welded joints and pipes. If a leak is present, the escaping gas causes the test solution to bubble. After all leaks are found and marked, relieve system pressure, and repair the leaks. Never attempt to repair soldered or welded joints while the system is under pressure. Defective joints should be opened and resoldered. Do not add more solder to the leaking joint. After all the joints are repaired and the system is considered "tight", retest the system with refrigerant.

Attach a drum of refrigerant to the system and allow the gas to enter until a pressure of 5 psig (34.47 kPa) is reached. Remove the refrigerant drum and bring pressure to the recommended test level with oil pumped dry nitrogen. Check the system for leaks using an appropriate leak detector. Check all flanged, welded, screwed, and soldered joints, all gasket joints, and all parting lines on castings. If leaks are found, repair and recheck them before the system is considered tight. No repairs should be made to welded or soldered joints while the system is under pressure.

C. Evacuating The System

A refrigeration system operates best when only refrigerant is present. Steps must be taken to remove all air, water, vapor, and all other non-condensibles from the system before charging it with refrigerant. A combination of moisture and refrigerant, along with any oxygen in the system, can form acids or other corrosive compounds which corrode internal parts of the system.

To properly evacuate the system, and to remove all non-condensibles, air and water vapor, use a high vacuum pump capable of attaining a blanked off pressure of 50 microns or less. Attach this pump to the system and allow it to operate until system pressure is reduced somewhere below 1000 microns. Evacuation should not be done unless the room temperature is 60°F (15.6°C) or higher.

Attach vacuum gauge(s), reading in the 20 to 20,000 micron gauge range, to the refrigerant system. These gauge(s) should be used in conjunction with the high vacuum pump. The reading from these gauge(s) indicates when the system has reached the lowest absolute pressure required for complete system evacuation.

Connect the high vacuum pump into the refrigeration system by using the manufacturer's instructions. Connect the pump both to the high side and low side of the system, to insure system evacuation. Attach the vacuum gauge to the system in accordance with the manufacturer's instructions.

A single evacuation of the system does not satisfactorily remove all of the non-condensibles, air and water vapor. To do a complete job, a triple evacuation is recommended. When the pump is first turned on, bring system pressure to as low a vacuum level as possible, and continue operation for 5 to 6 hours.

Stop the pump and isolate the system. Allow the unit to stand at this vacuum for another 5 to 6 hours. After this time, break the vacuum and bring the system pressure up to 0 psig (0 kPa) with dry nitrogen.

To begin the second evacuation, allow the pump to operate and reduce the pressure again to within 50 to 1000 microns. After this reading is reached, allow the pump to operate 2 or 3 hours, stop the pump and let the system stand with this vacuum and again with dry nitrogen, raise the system pressure to zero.

D. Evacuating The System (cont'd)

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

For the third evacuation, follow the previous procedure with the pump operating until system pressure is reduced below the 1000 micron level. Run the pump an additional 6 hours and hold the system for approximately 12 hours at low pressure. After this, again break the vacuum with dry nitrogen and allow the pressure in the system to rise slightly above zero pounds (psig). Install new drier cartridges and moisture indicators. Evacuate the system once more below the 1000 micron level, and charge with refrigerant designed for the system.

When properly evacuating the system as outlined above, the system is dry, oxygen-free and free of non-condensibles. The piping should not be insulated before the evacuation process is started. If moisture is in the system before evacuation, it will condense in low places and freeze. If this happens, it can be removed by gently heating the trap farthest away from the vacuum pump. This causes the ice to melt and water to boil. Water vapor collects in the next trap towards the vacuum pump. This process should be repeated until all pockets of water have boiled off, and the vacuum pump has had a chance to remove all the water vapor from the system.

XV. COMPRESSOR OIL CHARGING

Vilter Manufacturing Corporation has made available to the field, two models of oil charging pumps. One model pump is hand operated, while the second model is motor driven. (See the literature insert for more information.) Both pumps are used in putting the original oil charge into the compressor crankcase as well as charging oil later during service operations. Using either of these two pumps eliminates the need for providing a vacuum on the compressor in order to charge oil into it.

Both the hand operated Vilter charger and the Vilter motor driven charger attach quickly and easily to a 5 gallon container. Once connected

to the container, it can be left alone until it is empty.

The Vilter motor driven charger clamps to the top of the can with the dip tube extending down into the can. After the motor driven oil charger has been mounted on the top of the can, the can and charger may be moved around as a single assembly by the carrying handles on top of the motor driven oil charger. This too, can be left alone until the can is empty.

Both oil chargers are equipped with a length of hose with a female half of a quick connector mounted on it. The female half is easily and quickly snapped onto the male half of the connector, which is attached to the oil charging valve on the compressor crankcase.

If more than one compressor is used, it is recommended extra male halves of the quick connectors be purchased, and installed on each machine. This makes it easy to connect either of the two pumps to the oil charging valve and charge the required amounts of oil into the compressor crankcase.

To charge oil into the compressor with either of the oil chargers, first attach the female half of the connector to the male half. Open the oil charging valve to the compressor crankcase, and in the case of the hand operated oil charger, the pump is hand operated until such time as sufficient oil is pumped into the crankcase. Using the hand operated charger, approximately 8 full strokes are needed to force 1 pint of oil into the crankcase.

Using the Vilter motor driven chargers after the two halves of the quick connector are connected, and the oil charging valve is opened, turn on the charger motor with the switch and allow it to operate until sufficient oil has been pumped into the compressor.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

XV. COMPRESSOR OIL CHARGING (cont'd)

After charging oil with either of the two chargers, the charging valve on the compressor should be closed to relieve pressure on the oil charger check valve and quick connector. With the Vilter motor driven oil charger, take care not to operate the charger unless the oil charging valve on the crankcase is open.

If a motor driven charger is allowed to operate with this valve closed, enough pressure might build up to rupture the charging hose or cause damage to the pump. The pump motor is protected by means of an automatic cut-out switch mounted in the motor. However, do not allow the motor to cycle repeatedly on this cut-out device or damage to the motor will result. For the correct oil charge for VMC Compressors, refer to Table 7.

Reserve one to two gallons of the total compressor oil charge and charge into the compressor via the oil gauge connection just before initial start-up. Follow this same procedure after a compressor is shut down for an extended period of time. This helps eliminate "dry" start-up by forcing oil into small oil passageways. Charging oil at this point is done as follows:

Remove the oil pressure gauge and Stedy-Mount®. Connect the oil charging hose (electric or manual) to the oil pressure gauge connection. Open the valve and begin charging. Continue charging until a sufficient amount of oil is charged. Disconnect charging hose, close valve and reassemble gauge and Stedy-Mount.

When several compressors are connected to a common system, it is recommended that oil equalizing connections between compressors be provided. This eliminates the possibility of oil build up in one compressor and insufficient oil in others.

TABLE 7. COMPRESSOR CRANKCASE OIL CHARGE

COMPRESSOR SIZE CYLINDER QUANTITY	OIL CHARGE (GALLONS)	
	300 SERIES COMPRESSOR	400 SERIES COMPRESSOR
2	---	5
3	3½	---
4	3½	7
5	3½	---
6	3½	7
7	3½	---
9	3½	7
12	---	14
16	---	14

A. Oil for VMC Compressors

Due to the need for adequate lubrication Vilter recommends only the use of Vilter lubricants, designed specifically for Vilter VMC Compressors. With the extensive research Vilter has performed, we are able to offer refrigerant specific lubricating oils. Use of oil not specified or supplied by Vilter will void the compressor warranty.

Please contact your local Vilter representative or Home Office for further information.

XVI. SYSTEM REFRIGERANT CHARGING

After the system is leak-free and evacuation is complete, it is ready for charging. Prior to final charging, the entire operation of the refrigeration system should be inspected as outlined below:

A. Equipment Inspection

1. Low Side Equipment

- Fans on air handling equipment running.
- Pumps on water cooling equipment running.
- Proper location and attachment of thermostatic expansion valve bulb to suction line.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

1. Low Side Equipment (cont'd)

- d) Correct fan and pump rotation.
- e) Evaporator pressure regulators and solenoid valves open.
- f) Water pumps and motor correctly aligned.
- g) V-belt drives accurately aligned and tensioned.
- h) Proper power voltages to motors.

2. Compressors

- a) Correct oil level.
- b) Voltage agrees with motor characteristics.
- c) Properly sized motor fuses and heater.
- d) V-belt drives aligned and couplings tight.
- e) Direct drives aligned and couplings tight.
- f) All suction and discharge valves open.
- g) All gauges reading correctly.

3. Condenser

- a) Water available at water cooled condensers and supply line valve open.
- b) Water in sump of evaporative condenser and make-up water available.
- c) Correct rotation of pump and fan motors.
- d) V-belt drives aligned and tensioned correctly.
- e) Pump, fans and motor lubricated.

4. Controls

- a) Controls at proper setting.

B. Refrigerant Charging

There are two methods of charging refrigerant into the system, through the "high side" or through the "low side". High side charging is usually used for initial charging because this method fills the system much faster. Low side charging is usually reserved for adding only

small amounts of refrigerant after the system is in operation.

1. High Side Charging – Initial Charging

- a) Connect a full drum of refrigerant to the liquid charging valve, following all applicable safety and venting law procedures.
- b) Invert the refrigerant drum if drum is not equipped with "Liquid" and "Vapor" valves, and place in such a position the refrigerant can only enter the system. The vacuum in the system will draw in the refrigerant. It is important that during this operation, the air handling units are running and water is circulating through the chillers. The low pressures in the system can cause the refrigerant to boil at a low temperature and possibly freeze the water if it is not kept circulating. Water freezing in a chiller can rupture the tubes and cause extensive damage to the system. It is desirable to charge the initial amount of refrigerant without water in the shell and tube equipment to eliminate the possibility of freeze up.
- c) After some refrigerant has entered the system, carefully start the compressor. It is essential the compressor be allowed to pick up the load gradually and let it run for a few minutes at a time. During its intermittent operating period, the operator should check for proper oil pressures and excessive heating at the bearings. In between running periods, allow the compressor to cool. The running periods may be gradually lengthened until the operator is sure no moving parts are heating excessively. The compressor may then be operated automatically.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

1. High Side Charging – Initial Charging (cont'd)

CAUTION

Take care refrigerant does not flood into the compressor. Liquid slugging can cause considerable damage.

- d) Continue charging refrigerant into the system until the design operating requirements are satisfied. Close the liquid charging connection. Open the liquid line valve allowing the system to operate normally. When enough refrigerant has been added, the liquid sight glass shows no bubbles, and the receiver will be sealed. If these two conditions are not satisfied, add additional refrigerant.
- e) When sufficient refrigerant is charged into the system, close the charging and drum valves. Then remove the drum from the system.
- f) During the charging period, watch the gauge to ensure no operating difficulties. Check head pressure to make sure condensers are functioning properly.

Since it is usually necessary to use more than one drum when charging a system, follow procedures in paragraph (a) and (b) under the title "High Side Charging – Initial Charging", when attaching a new drum. After charging, keep the refrigerant drums nearby for several days as it is sometimes necessary to add more refrigerant once the system "settles down".

2. Low Side Charging – Adding Refrigerant To Operating System

Use low side charging on small systems only when adding a small amount of refrigerant. Unlike high side charging, where refrigerant is added as a liquid, in low side charging, refrigerant enters as a gas. This method is relatively slow. To charge refrigerant into the low side, use the following procedure:

- a) Keep the refrigerant drum in an upright position. Close the valve to the suction gauge and remove the line to the suction valve. Attach a tee to the valve and reconnect the gauge to the tee. Connect the charging line, following all applicable safety and venting law procedures.
- b) To charge gas into the compressor, throttle the valve to create a lower pressure in the compressor.

Open the drum valve marked "Vapor", if drum is equipped with two valves. Then, open the gauge valve and refrigerant will draw out of the drum and into the compressor.

FOR HALOCARBON UNITS ONLY

During the charging process, the drum may get too cold. This prevents gas from boiling off fast enough. Heat can be applied to the drum. Place the drum in a pail of warm water not exceeding 125°F (51.7°C) or wrap the drum in burlap and pour hot water on it.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

2. Low Side Charging – Adding Refrigerant To Operating System (cont'd)

CAUTION

Direct flame or steam must NEVER be applied directly to the drum, as this can produce dangerous pressures in the drum.

- c) Check the sight glass during charging. When the bubbles stop, close the drum valve. Next, close the suction valve and operate the system in the normal manner. Remove the refrigerant drum from the system and replace the gauge in its normal position.

XVII. THE INITIAL START

Before starting the compressor and putting the system into use, it is advisable to check certain items to assure proper operation.

A. Controls

Check the setting of the dual pressure switch so the compressor starts at the desired suction pressure and the cut-out or differential is set low enough to prevent short cycling.

The high pressure cut-out switch should be checked for proper setting. The cut-out set point for R22 is 275 psi (1806.07 kPa) and for R717 is 225 psi (1551.33 kPa).

Electrical interlocks, which are installed mainly for system component protection, should be checked to ensure they are functioning properly. All safety controls must always be wired into the compressor electrical circuit to ensure protection for the compressor.

Check the superheat setting of the thermostatic expansion valve. Take a temperature reading at the remote bulb of the valve and compare it with the temperature corresponding to the suction pressure. The bulb temperature should be

about 10 degrees greater than suction temperature. If there is a large pressure drop in the low side of the system, the above method does not apply and the evaporator pressure should be determined from superheat and pressure drop.

Thermostats should be set for desired temperature.

The condenser water regulating valve should be adjusted to maintain the design head pressure. Open for increased flow in cases of high compressor head pressure and close for decreased flow in case of low head pressure.

B. Final Precautions

The compressor suction valve, compressor discharge valve, condenser water shut-off valve, and other shut-off valves should be open.

Running parts of the compressor should have freedom of movement. Check this by turning the compressor input shaft over by hand.

Solenoid valves should be mechanically connected and under electrical control. All gauges should be open and functional.

Oil level in the sight glass shows at least one half full.

Before initial compressor start-up, verify that the oil charging procedure (as outlined in paragraph XVI) is followed. If the procedure is followed, compressor start-up should commence as follows:

It is essential the compressor pick up the entire load gradually. It should be run for a few minutes and then stopped for a cooling off period. Lengthen each running period until the operator is sure no moving parts are heating up excessively. When the compressor operates with normal running temperatures, allow it to run for whatever length of time the load requires.

C. Final Precautions (cont'd)

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

After the compressor is running, to provide quick response from the compressor unloader mechanism, set the oil relief valve to maintain 45 psi (310.27 kPa) net oil pressure in the 400 Series Compressors, and 65 psi (448.15 kPa) net in the 300 Series Compressors. Hold net oil pressure between 45 psi (310.27 kPa) and 50 psi (344.74 kPa) in the 400 Series Compressors and between 60 psi (143.69 kPa) and 70 psi (482.64 kPa) in the 300 Series Compressors.

NOTE:

Net oil pressure is calculated by subtracting the compressor suction pressure from the oil pressure gauge reading while the compressor is running. The pressure is regulated by turning the adjusting valve stem. See Table 8 for location. To raise the oil pressure, turn the valve stem to the right, or in. Turning the valve stem to the left, or out, decreases the oil pressure.

TABLE 8. OIL PRESSURE ADJUSTING VALVE LOCATIONS

COMPRESSOR	VALVE LOCATION
Model 300 Series	Rear Bearing Housing (Oil Pump-Filter End)
Model 400 Series	Front Bearing Housing (Drive-Seal End)

CAUTION

When the Compressor has completed 24 hours of operation, remove and inspect the suction strainer bag. This bag is placed in the suction strainer to catch any foreign material present in the system at "start-up". If, when the bag is removed and inspected, there is an unusual amount of dirt, install a new bag. After another 24 hour period, remove and inspect the bag. Continue doing this until all traces of foreign material are removed from the system. The bag may then be thrown away. Whenever welding is performed on system piping, a suction bag should be installed.

After discarding the bag, remove decal from the outside of the suction strainer cover and discard to avoid confusion. Decal is not needed if bag is not used.

Clean the suction strainer after the first week of operation, the first month, and every six months after that. The best method of doing this is to remove it from the machine, knock the solids out, and wash it thoroughly with mineral spirits before replacing it in the machine.

XVIII. MAINTENANCE SUGGESTIONS

To insure the compressor against component malfunctions and system failure, a systematic preventive maintenance program is highly recommended. Performing the following steps at the prescribed intervals will keep the VMC Compressor in optimum working condition.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

A. Daily

Clean the suction screen bag. Discontinue use when the bag remains clean. Reserve for system modifications or overhauls.

B. Weekly

1. Check system for leaks with a suitable leak detector for first week of operation.
2. Check oil levels and oil condition.
3. Check oil pressures. Determine if oil filter needs changing.
4. Check refrigerant levels in vessels.
5. Check filters in air handling units.
6. Check low temperature coils for defrosting.
7. Check all gauge and temperature readings.

C. Monthly (Items 1 thru 7 and 8 thru 11)

8. Lubricate each piece of equipment in accordance with the manufacturer's instructions. As a general guide, bearings requiring oil should be given attention at least once a month, and those requiring grease at least once every six months.
9. Check drives for tightness and alignment. Direct drives should have coupling bolts tightened. V-belt drives should have correct tension.
10. Check cooling towers and evaporative condensers for scaling or algae. Check sprays and screens for clogging. Consult manufacturers of water treatment supplies for corrective measures of scaling and algae problems.

11. Check compressor oil coolers (when used) for any evidence of corrosion, scaling, or other fouling. See paragraph XI.C for maintenance and servicing.

D. Yearly (Items 1 thru 11 and 12 thru 21)

12. Check entire system thoroughly for leaks
13. Drain water from condensers, cooling towers and check tubes. Check carefully for damage by corrosion or scale.
14. Remove all rust from equipment, clean and paint.
15. Check motors and fans for shaft wear and end play.
16. Check operation and general condition of electrical controls.
17. Check all water strainers.
18. Check all V-belt drives. Replace worn V-belts and drive components.

CAUTION

Replace V-belts in matched sets only.

19. Check drains to make sure water will flow away from equipment.
20. Drain and clean compressor crankcase. Flush oil circuit. Replace oil filter recharge. Recharge with new, clean, water-free oil.
21. Check and clean suction strainer.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

E. System Leaks

Because of the demanding operational constraints of the VMC Compressor (temperature variations, loosening of joints due to vibration, etc.), the need to periodically test for leaks is a necessity. When any service operation is performed on the system, exercise care to make sure all opened flanges are replaced with a suitable thread filling compound, all packing glands on valve stems are tightened, and all valve caps are replaced. When operation is restored, all joints opened or any valves moved during the servicing should be checked for leaks.

F. Year-Round Operation

When refrigeration equipment is operated on a continuous year-round basis, a yearly examination of all internal compressor parts is recommended. While the highest material standards are maintained through the Vilter VMC Compressor line, continuous operation and any presence of grime may prove detrimental to the machine. To prevent shutdowns and/or possible breakdowns, your machine should be opened annually. The condition of the internal components should be fully inspected to determine if parts need replacement or repair.

G. Flushing The Oil Circuit

The oil circuit of the Vilter VMC Compressor is protected against dirt, grit, and other foreign material by strainers and filters. Despite the filtering system, microscopic particles of foreign materials are carried through the lubrication system. These materials tend to settle in and clog the oil passages. Vilter recommends the oil circuit in the crankshaft be flushed periodically. It should also be done whenever the machine is opened for repairs. Use mineral spirits or some other suitable refrigerant parts cleaner for flushing purposes. Since the flushing fluid is pumped under pressure, the use of the Vilter oil charger is recommended.

The machine should be pumped down for servicing, the oil taken out and the handhole cover removed. Remove the 1/4" (6.35 mm) pipe plug from the top of the seal chamber. Connect the Vilter oil charger to this opening. Pump the flushing solution through the seal chamber and into the crankshaft. Remove each of the pipe plugs in the crankshaft individually and operate the pump until the cleaner is flushed through the hole. Remove the plug, remove the next one and repeat the pumping procedure.

After the plugs are removed and these passages flushed, remove the bearing caps and connecting rods. Examine each of the oil passages to the connecting rods. Inspect the connecting rod bearings.

The preceding instructions enable a mechanic/technician to flush the shaft and passages on the 2 through 8 cylinder machines, and the drive end of the 12 and 16 cylinder machines. In order to flush the pump end of the shaft on the 12 and 16 cylinder machines, remove the connection to the center bearing and connect the pump there. Perform the flushing procedures in the same manner for this end of the shaft as for the other end.

After the passages are flushed, open the connection on the bottom of the seal chamber and drain the flushing fluid out. Drain solvent from the crankcase and the interior surfaces of the machine. Replace the pipe fitting in the bottom of the seal chamber and fill the chamber with clean oil. Be sure to pump in enough oil to fill the passages in the crankshaft. Follow the procedure found in Paragraph XVI. Remove the pump and replace the fitting in the top of the seal chamber.

Replace the crankcase cover and charge the machine with clean oil.

H. Crankshaft Seal Oil Leakage

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

In refrigeration compressors, a slight amount of oil leakage past the crankshaft seal is normal and acceptable. It lubricates the bellows and o-rings and cools mating rotating parts to provide less wear and longer life. Make provisions for collecting this oil.

fied personnel are not available to perform the preventive maintenance, which is recommended.

J. Seasonal Operation



In instances where there is a seasonal operation of air conditioning systems, special considerations must be given to the equipment. Whenever equipment is shut down for any length of time, as over the winter, "pumpdown" the refrigerant and store it in the receiver. Only experienced refrigerant personnel should perform this operation.

Never fill the receiver to more than 80% of its capacity and after filling, it should be thoroughly checked for leaks.

When starting up a system after a seasonal shutdown, allow only enough refrigerant to enter the system to pressurize for leak testing.

Any leaks that may have developed during the shut down period may be found with a minimum of refrigerant loss. It is extremely important to check for leaks before a system is put back into operation. Be sure the system is sealed before the full supply of refrigerant is allowed to enter it. After the system has operated for several hours, another leak check should be made.

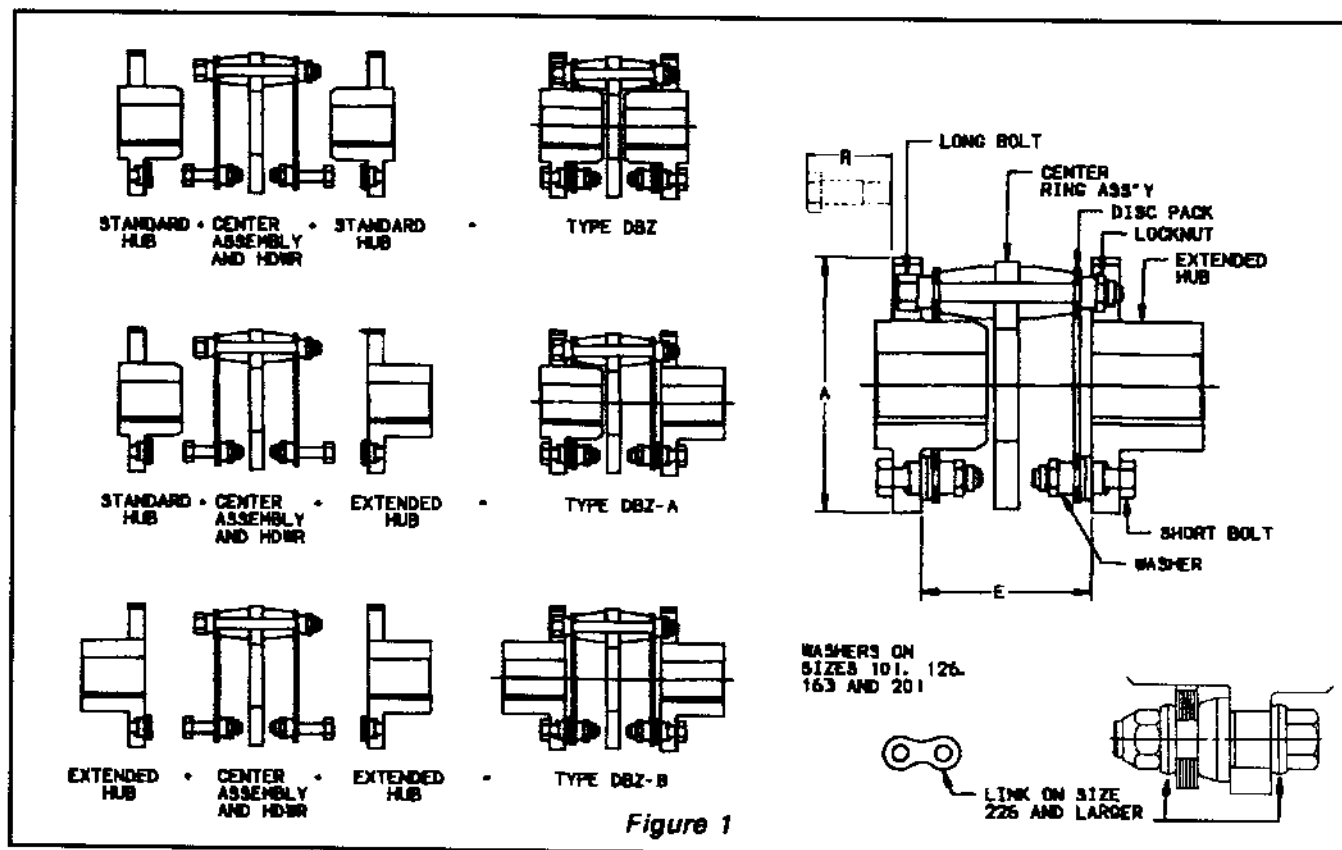
K. Service Contracts

Vilter Distributors offer a variety of maintenance, inspection, and repair services. Plans are available for almost any need. It is recommended that owners avail themselves of these services. If a Vilter Distributor is not available in your area, contact the Vilter Manufacturing Corporation Home Office. Provisions for a service contract should be carefully considered by the plant management. This is especially important for owners of small plants, where quali-

TYPE DBZ, DBZ-A, DBZ-B Couplings

Thomas Installation Instruction

Warning: All rotating power transmission products are potentially dangerous and must be properly guarded in compliance with OSHA standards for the speed and applications for which they are intended. It is the responsibility of the user to provide proper guarding.



I. **Purpose:** These instructions are intended to help you to install, align, and maintain your THOMAS coupling.

II. **Scope:** Covered here will be general information, hub mounting, alignment, assembly, locknut torquing, disc pack replacement, and part numbers.

III. **General Information:** The coupling as received, may or may not be assembled. If assembled, the locknuts are not torqued. Examine the parts to assure there is no visible damage. If coupling is assembled, remove the bolts that attach the hubs to the disc packs. Remove both hubs. Leave the disc packs attached to the center member.

IV. Hub Mounting:

- A. General.** Clean hub bores and shafts. Remove any nicks or burrs. If bore is tapered, check for good contact pattern. If the bore is straight, measure the bore and shaft diameters to assure proper fit. The key(s) should have a snug side-to-side fit with a small clearance over the top.

NOTE: If the DBZ hub position on the shaft does not allow enough room to install the short bolts in the hub after hub mounting, install the bolts and disc pack before mounting hub on shaft. See Section VI A & B

- B. Straight Bore.** Install key(s) in the shaft. If the hub is an interference fit, heat the hub in an oil bath or oven until bore is sufficiently larger than the shaft. 350 degrees F. is usually sufficient. An open flame is not recommended. However, if flame heating is necessary, use a very large rose bud tip to give even heat distribution. A thermal heat stick will help determine hub temperature. **DO NOT SPOT HEAT THE HUB OR DISTORTION MAY OCCUR.** With the hub expanded, slide it up the shaft to the desired axial position. A pre-set axial stop device can be helpful.

NOTE: All DBZ hubs have pressed-in bushings. Make sure the bushings are facing the disc pack.

- C. Taper Bore.** Put the hub on the shaft without key(s) in place. Lightly tap hub up the shaft with a soft hammer. This will assure a metal-to-metal fit between shaft and hub. This is the starting point for the axial draw. Record this position between shaft end and hub face with a depth micrometer. Mount a dial indicator to read axial hub movement. Set the indicator to "0". Remove hub and install key(s). Remount hub, drawing it up the shaft to the "0" set point. Continue to advance hub up the taper to the desired axial position. Use the indicator as a guide only. A pre-set axial stop device can be helpful. Check the final results with depth micrometer. The hub may have to be heated in order to reach the desired position on the shaft. **DO NOT SPOT HEAT THE HUB OR DISTORTION MAY OCCUR.** Install shaft locknut to hold hub in place.

- B. Axial Spacing.** The axial spacing of the shafts should be positioned so that the disc packs (flexing elements) are flat when the equipment is running under normal operating conditions. This means there is a minimal amount of waviness in the disc pack when viewed from the side. This will result in a flexing element that is centered and parallel to its mating flange faces. Move the connected equipment or hubs on their respective shafts to accomplish the above. As a guide, maximum and minimum values for dimension "E" are given. See Table 1 and Figure 1.

- C. Angular Alignment.** Rigidly mount a dial indicator on one hub or shaft, reading the face of the other hub flange, as shown in Figure 2. Rotate both shafts together making sure the shaft axial spacing remains constant. Adjust the equipment by shimming and/or moving so that the indicator reading is within .002 inch per inch of coupling flange diameter. See Chart (A)

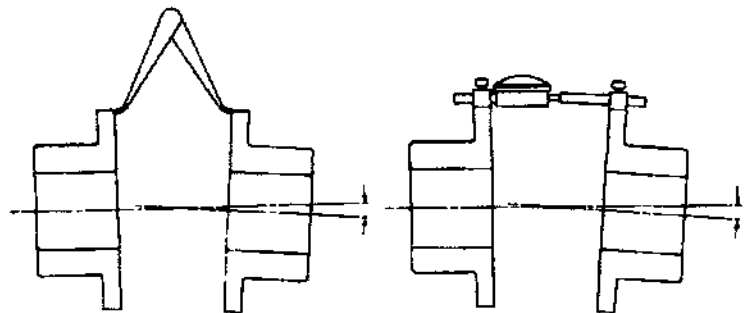


Figure 2

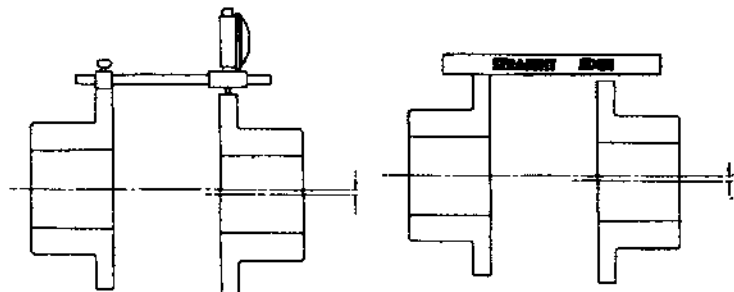


Figure 3

V. SHAFT ALIGNMENT. Move equipment into place.

- A. Soft Foot.** The equipment must sit flat on its base. Any soft foot must be corrected now.

SUGGESTED MAXIMUM ALIGNMENT VALUE

COUPLING SIZE	TOTAL INDICATOR READING (T.I.R.)	
	ANGULAR	PARALLEL
50	.004	.003
62	.005	.003
75	.005	.003
101	.008	.004
126	.007	.005
163	.009	.005
201	.010	.006
226	.012	.007
263	.014	.009
301	.016	.010
351	.018	.012
401	.020	.013
451	.024	.014

CHART A

D. Parallel Offset. Rigidly mount a dial indicator on one hub or shaft, reading the other hub flange outside diameter, as shown in Figure 3. Indicator set-up sag must be compensated for. Rotate both shafts together. Adjust the equipment by shimming and/or moving so that the indicator reading is within .002 inch per inch of the axial length between flex elements. See Chart (A)

NOTE: If the driver or driven equipment alignment specification is tighter than these recommendations, the specification should be used. Also, be sure to compensate for thermal movement in the

equipment. The coupling is capable of approximately four times the above shaft misalignment tolerances. However, close alignment at installation will provide longer service with smoother operation.

VI. FINAL ASSEMBLY. With the coupling in good alignment, the bolts will fit through the holes in the flanges and the disc packs more easily.

A. If the coupling arrived assembled, the disc packs are still attached to the center ring. Before taking the disc packs off, first install one hub bolt through each disc pack and secure with a locknut. This will help when the pack is reinstalled later. If the coupling was shipped disassembled, the bolt through the pack is not required as the discs in the pack are factory-taped together.

B. Remove the long bolts. Mount the disc packs on the hubs with the one bolt through the disc pack aligned with a clearance hole in the hub. Install the short bolts through the hub, disc pack, bevel washer or link, and secure with a locknut.

NOTE: All bolt threads should be lubricated. A clean motor oil is recommended.

On size 226 and larger, a link must be put on the bolt first. Remove the disc pack alignment bolt. Proceed to mount the second disc pack to the other hub in the same way.

Table 1
Locknut Tightening Torques

Coupling Size	"A" Diameter	Dimension "E"		Dimension "R"	Thread Size	Torque Ft.-Lbs. (In.-Lbs.)
		Min.	Max.			
50	2.00	1.36	1.37	1.41	#6-40	(24)
62	2.44	1.74	1.75	1.75	#10-32	(36)
75	2.69	1.77	1.78	1.75	#10-32	(36)
101	3.22	2.08	2.10	1.97	#12-28	(96)
126	3.84	2.46	2.48	2.31	1/4-28	(156)
163	4.56	2.46	2.48	2.31	1/4-28	(156)
201	5.34	2.96	2.98	2.89	5/16-24	25
226	6.06	3.83	3.85	3.31	3/8-24	30
263	7.00	4.33	4.35	3.75	7/16-20	40
301	8.00	4.90	4.93	4.44	1/2-20	95
351	9.38	5.90	5.93	5.44	5/8-18	175
401	10.89	6.71	6.75	6.16	11/16-16	200
451	12.13	7.27	7.31	6.75	3/4-16	260

NOTE:

- These torque values are approximate for steel bolts with lubricated threads. Modification will be necessary for stainless steel. For stainless steel the tightening torque must be reduced to 60% of the values shown. Bolt and locknut threads must also be liberally coated with molybdenum disulfide grease.
- Bolts should be held from rotating while the locknuts are torqued to the values shown.

C. Position one set of short bolts in each hub on top. Now slide the center ring down into place straddling the short bolts with the center ring bushings. If coupling is dynamically balanced, the center ring match marks must line up with both hub match marks. When one bushing is in line with the hole in the disc pack, slide one long bolt through washer or link, disc pack, center ring, disc pack, washer or link, and then secure with a locknut. The long bolt requires a minimum clearance "R" for installation between back side of coupling flange and stationary equipment. See Figure 1 and Table 1 for value of "R". On size 226 and larger a link must be put on the bolt first. Now install the rest of the long bolts in the same manner.

D. Torque the long bolt locknuts at this time. See Table 1 for torque values.

NOTE: With the coupling in good alignment the bolts will fit through the holes in the flanges and the disc pack more easily.

It is recommended that all locknuts be retightened after several hours of initial operation.

E. For further help with the installation or alignment, consult Rexnord.

VII. **Disc Pack Replacement.** If it becomes necessary to replace the disc pack, it can be done as follows:

A. Remove all the long bolts and lower the center ring by sliding it out from between the two disc packs.

B. Remove one short bolt from the disc pack/hub connection and re-install it through a hub clearance hole and into the hole in the disc pack. Put the nut on. This will keep the discs together and maintains the disc orientation for later reinstallation. Remove the rest of the short bolts and take off the disc pack. Repeat for the second disc pack.

C. Replace the pack(s) if required. Recheck alignment per Section V. Reassemble per Section VI.

VIII. For spare replacement parts see Table 2.

Table 2
Part Number and Quantity Required

Size of DBZ DBZ-A DBZ-B	Std. Hub	Ext. Hub	Center Ring	Disc Pack Two per Cplg.		Parts Kit consists of Washers or Links, Bolts, and Locknuts for one Coupling								
	Part No.	Part No.	Part No.	Tom- aloy	Stain- less	Parts Kit	Washer or Link		Long Bolt		Short Bolt		Locknut	
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Qty.	Part No.	Qty.	Part No.	Qty.	Part No.	Qty.
50	114401	514402	314405	710492	910492	716320	none	—	312659	2	210495	4	711738	6
62	414412	114413	014416	510601	710601	816320	none	—	112657	2	010525	4	011739	6
75	114423	814424	514427	710523	910523	816320	none	—	112657	2	010525	4	011739	6
101	716104	216105	814438	910619	310619	916320	511192	8	711162	2	411161	4	516503	6
126	116106	816107	414445	910618	310618	116320	002161	8	811198	2	510728	4	916504	6
163	816108	616109	016022	410954	610954	416320	002161	16	811198	4	510728	8	916504	12
201	416110	016111	414471	710624	910624	001950	002170	16	411206	4	210721	8	316505	12
226	616112	116113	614482	010689	210689	001953	011874	12	011250	4	010634	8	716506	12
263	716114	216115	514491	920357	120357	001956	211875	12	710788	4	410787	8	116507	12
301	416116	516117	414500	420359	620359	001958	411876	12	310656	4	010655	8	516508	12
351	616118	716119	314509	820361	020361	001960	711877	12	410734	4	110733	8	316510	12
401	816120	916121	914516	220363	420363	001962	011878	12	310241	4	110240	8	716511	12
451	016122	116123	514523	310646	510646	001964	311879	12	910642	4	710641	8	116512	12

For further assistance, call Rexnord Corp. Coupling Operation, Warren, PA — 814-723-6600
FAX 814-726-1740



TYPE CMR/AMR Couplings

Thomas **Installation Instruction**

Warning: All rotating power transmission products are potentially dangerous and must be properly guarded in compliance with OSHA standards for the speed and applications for which they are intended. It is the responsibility of the user to provide proper guarding.

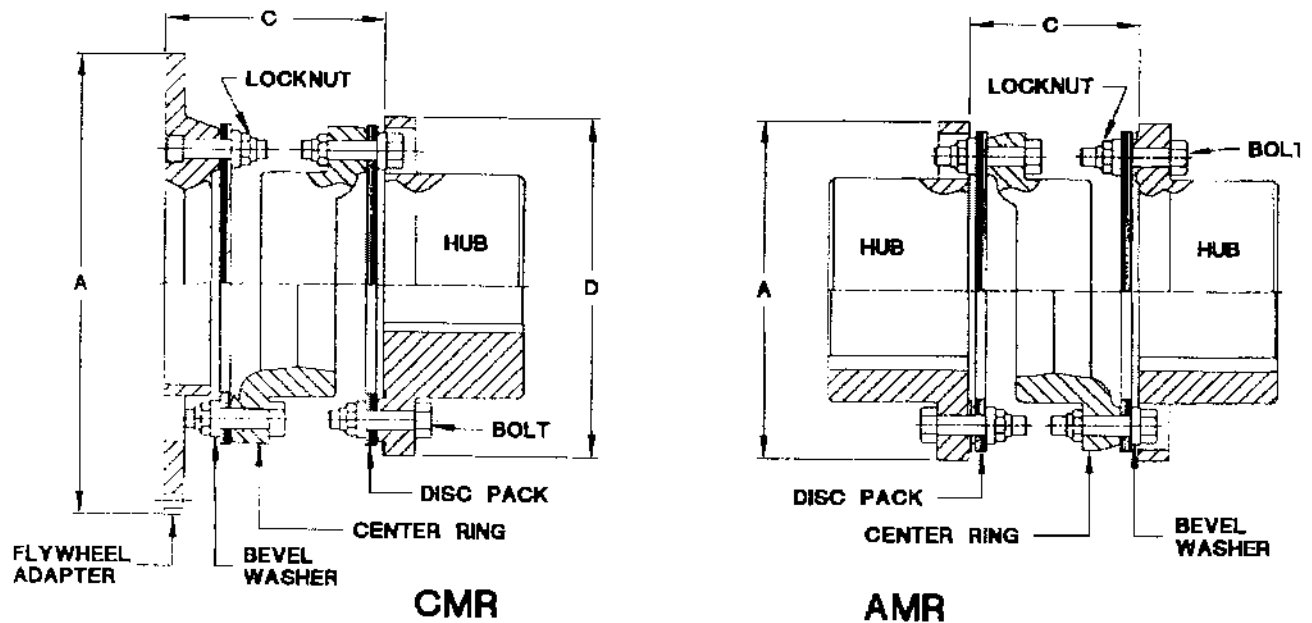


Figure 1

- I. **Purpose:** These instructions are intended to help you to install, align, and maintain your THOMAS coupling.
- II. **Scope:** Covered here will be general information, hub mounting, alignment, assembly, locknut torquing, disc pack replacement, and part numbers.
- III. **General Information:** The coupling, as received, may or may not be assembled. If assembled, the locknuts are not torqued. Examine the parts to assure there is no visible damage. If coupling is assembled, remove the bolts, locknuts, and washers that attach the hub(s) to the disc pack. Remove the hub(s). Leave the disc packs attached to the center ring and the flywheel adapter (when used).
- IV. **Hub Mounting:**
 - A. **General.** Clean hub bore and shaft. Remove any nicks or burrs. If bore is tapered, check for good contact pattern. If the bore is straight, measure the bore and shaft diameters to assure proper fit. The key(s) should have a snug side-to-side fit with a small clearance over the top.
 - B. **Straight Bore.** Install key(s) in the shaft. If the hub is an interference fit, heat the hub in an oil bath or oven until bore is sufficiently larger than the shaft. 350 degrees F. is usually sufficient. An open flame is not recommended. However, if flame heating is

necessary, use a very large rose bud tip to give even heat distribution. A thermal heat stick will help determine hub temperature. **DO NOT SPOT HEAT THE HUB OR DISTORTION MAY OCCUR.** With the hub expanded, slide it quickly up the shaft to the desired axial position. A pre-set axial stop device can be helpful.

- C. **Taper Bore.** Put the hub on the shaft without key(s) in place. Lightly tap hub up the shaft with a soft hammer. This will assure a metal-to-metal fit between shaft and hub. This is the starting point for the axial draw. Record this position between shaft end and hub face with a depth micrometer. Mount a dial indicator to read axial hub movement. Set the indicator to "0". Remove hub and install key(s). Remount hub, drawing it up the shaft to the "0" set point. Continue to advance hub up the taper to the desired axial position. Use the indicator as a guide only. A pre-set axial stop device can be helpful. Check the final results with depth micrometer. The hub may have to be heated in order to reach the desired position on the shaft. **DO NOT SPOT HEAT THE HUB OR DISTORTION MAY OCCUR.** Install shaft locknut to hold hub in place.

V. SHAFT ALIGNMENT. Move equipment into place.

- A. Soft Foot (footplane).** The equipment must sit flat on its base. Any soft foot must be corrected now.
- B. Axial Spacing.** The axial spacing of the shaft should be positioned so that the disc packs (flexing elements) are flat when the equipment is running under normal operating conditions. This means there is a minimal amount of waviness in the disc pack when viewed from the side. This will result in a flexing element that is centered and parallel. Move the connected equipment or hub(s) on their respective shaft(s) to accomplish the above.

NOTE: The disc pack is designed to an optimal thickness and is not to be used for axial adjustments.

As a guide, maximum and minimum values for dimension "C" are given. These dimensions are suggested for initial installation. Additional capacity is available to compensate for thermal and structural movement. Maximum axial capacity values for these couplings are also given. See Table 1 and Figure 1.

- C. Angular Alignment.** Rigidly mount a dial indicator on one hub or shaft, reading the face of the other hub flange or flywheel adapter, as shown in Figure 2. Rotate both shafts together making sure the shaft axial spacing remains constant. Adjust the equipment by shimming and/or moving so that the indicator reading is within .002 inch per inch of coupling flange diameter. See Chart (A).

- D. Parallel Offset.** Rigidly mount a dial indicator on one hub or shaft, reading the other hub flange or flywheel adapter outside diameter, as shown in Figure 3. Compensate for indicator set-up sag. Rotate both shafts together. Adjust the equipment by shimming and/or moving so that the indicator reading is within .002 inch per inch of the axial length between flex elements. See Chart (A).

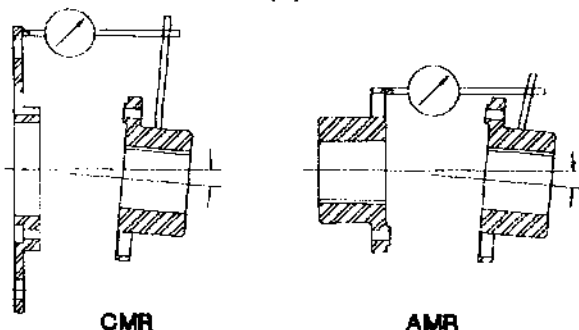


Figure 2

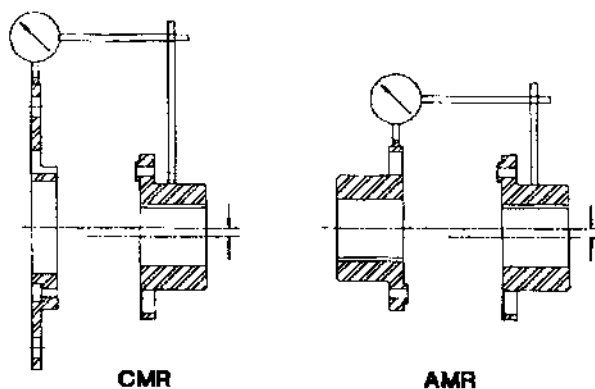


Figure 3

NOTE: If the driver or driven equipment alignment specification is tighter than these recommendations, then those manufacturer's specifications should be used. Also, be sure to compensate for any thermal growth which may occur during normal equipment operation. The coupling is capable of approximately three times the shaft misalignment tolerances shown in the chart below. However, the more exact the alignment is at installation will definitely result in a much longer coupling life and smoother operation.

COUPLING SIZE	TOTAL INDICATOR READING (T.I.R.)		
	ANGULAR for AMR	ANGULAR for CMR	PARALLEL
182	.009	.002 INCHES PER INCH OF "A" DIA.	.005
200	.011		.006
225	.012		.006
282	.014		.007
312	.016		.008
350	.018		.009
375	.020		.010
425	.022		.011
450	.024		.012
500	.027		.014
550	.030		.015
600	.033		.017
700	.038		.019
750	.041		.021
800	.045		.023
850	.047		.024
925	.051		.026
1000	.056		.029
1100	.060		.031
1200	.067		.034
1300	.073		.036

CHART (A)

VI. FINAL ASSEMBLY. With the coupling in good alignment, the bolts will fit through the holes in the flanges and the disc packs more easily. See Figure 1.

A. When fly wheel adapter is used - CMR.

1. If the coupling arrived assembled, the disc packs, center ring, and flywheel adapter are still attached. Before taking the disc pack off the hub end, first install one hub bolt through the disc pack and secure with a locknut. This will help when the pack is reinstalled later. Remove disc pack. If the coupling was shipped disassembled, the bolt through the pack is not required as the discs in the pack are factory-taped together.
2. If coupling is not preassembled, start with the center ring on a work bench. Put the bolts through the bolt holes at one end. Slide the disc over the bolts. Add the washers. **The beveled side of the washer should always be against the disc pack.** Secure with the locknuts. Torque locknuts to the value shown in Table 1. Now mount the flywheel adapter to this disc pack by putting the bolts through the holes in the adapter from the back side seating the head of the bolt in the slot provided and then through the remaining disc pack holes. Add the washers, and secure with the locknuts. The locknuts can now be torqued to the values shown in Table 1.

NOTE: All bolt threads should be lubricated. A clean motor oil is recommended.

If the coupling was preassembled (flywheel adapter, disc pack, and center ring) the locknut in this sub assembly can be torqued to the values shown in Table 1.

The disc pack when installed should look flat and parallel with mating adapter and center ring fingers.

3. With the hub mounted and the span length "C" set, proceed to put the sub-assembly (flywheel adapter, disc pack, and center ring) into place between the flywheel and hub. Bolt the adapter to the flywheel in the manner prescribed by the engine manufacturer.
4. Now install the remaining disc pack. Rotate the hub or center ring so that the hub bolt holes line up between the center ring fingers. Start a bolt through the bolt hole in the hub. Hold the disc pack in one hand, slip it down between the hub and center ring until one hole in the disc pack lines up with the bolt. Slide the bolt through this hole into the disc pack. Add a washer. **The beveled side of the washer should always be against the disc pack.** Install the locknut.

Do not torque the locknut at this time. Remove the disc pack alignment bolt if used. Now pivot the pack around until it lines up with the rest of the bolt holes in the hub. Install the rest of the hub bolts through the hub bolt holes, disc pack, washers, and locknuts. The remaining bolts for this end can now be installed. These bolts go in from the hub side first through the washer, the disc pack and then the bolt hole in the center ring adding the locknut. The locknuts can be snugged up at this time. The disc pack as installed should look flat and parallel with the mating hub and center ring fingers.

5. Make the final coupling alignment check at this time.
6. Torque up the locknuts. See Table 1 for torque values.

NOTE: Due to tight nut body clearances, it may be necessary to use an open end wrench to torque the locknuts at the head end. The lock nut torque value can be easily calculated. Take the foot/pounds required

and divide it by the weight of the mechanic. This gives you the length of pipe needed to go over the wrench. The mechanic's weight hanging on this horizontal length of pipe will put the desired inch/pounds of torque on the locknut.

Example: A #925 CMR requires 1800 ft/lbs of torque. Mechanic's weight is 200 lbs.

$1800/200 = 9$ The distance from the center of the locknut to the mechanic should be 9 feet. This is a dead weight hanging force.

It is recommended that all locknuts be retorqued after several hours of initial operation.

B. When two hubs are used - AMR.

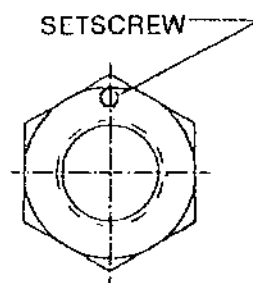
1. If the coupling arrived assembled, the disc packs are still attached to the center ring. Before taking the disc packs off, first install one hub bolt through each disc pack and secure with a locknut. This will help when the pack is reinstalled later. Remove disc pack. If the coupling was shipped disassembled, the bolt through the pack is not required as the discs in the pack are factory-taped together.
2. With the hubs mounted and the span length "C" set, proceed to put the center ring into place between the two hubs. Care should be taken when handling the center ring.

Support the center ring on wood blocks, with nylon straps from a hoist, or some other convenient way. It may help to support the end not being worked on with holts through the center ring bolt holes and into the hub flange bolt holes. This will hold the parts in line at that end.

3. Now install the disc pack. Rotate the hub or center ring so that the hub bolt holes line up between the center ring fingers. Start a bolt through a bolt hole in the hub. Hold the disc pack in one hand, slip it down between the hub and the center ring until one hole in the disc pack lines up with the bolt. Slide the bolt through this hole into the disc pack. Add a washer. **The beveled side of the washer should always be against the disc pack.** Install the locknut.

Table 1
Locknut
Tightening
Torques

Coupling Size	CMR="D" AMR="A" Diameter	Dimension "C" for CMR		Dimension "C" for AMR		Axial Capacity (in.)	Thread Size	Torque Ft.-Lbs. (In.-Lbs.)
		Min.	Max.	Min.	Max.			
162	4.56	3.33	3.35	2.64	2.66	± .036	1/4-28	(156)
200	5.75	3.89	3.91	3.02	3.04	± .036	5/16-24	25
225	6.00	3.89	3.91	3.02	3.04	± .036	5/16-24	25
262	6.88	4.45	4.47	3.52	3.54	± .043	3/8-24	30
312	8.12	5.33	5.36	4.14	4.17	± .051	7/16-20	40
350	9.12	5.89	5.92	4.58	4.61	± .056	1/2-20	95
375	10.06	6.64	6.67	5.14	5.17	± .062	9/16-18	130
425	11.00	7.14	7.17	5.58	5.61	± .067	5/8-18	175
450	11.88	7.64	7.67	5.96	5.99	± .072	11/16-16	200
500	13.44	8.77	8.81	6.83	6.87	± .082	3/4-16	260
550	15.00	9.89	9.93	7.71	7.75	± .092	7/7-14	255
600	16.75	10.89	10.94	8.46	8.51	± .102	1-14	335*
700	18.94	12.46	12.52	9.65	9.71	± .115	1-1/8-12	425*
750	20.62	13.53	13.59	10.53	10.59	± .125	1-1/4-12	560*
800	22.38	14.78	14.85	11.40	11.47	± .136	1-3/8-12	740*
850	23.75	15.78	15.85	12.15	12.22	± .144	1-1/2-12	950*
925	25.75	17.28	17.35	13.28	13.35	± .156	1-5/8-12	1800
1000	28.25	18.59	18.67	14.53	14.61	± .172	1-3/4-12	2350
1100	30.25	19.84	19.92	15.53	15.61	± .183	1-7/8-12	3000
1200	33.38	21.59	21.69	17.09	17.19	± .203	2-1/8-8	4000
1300	36.00	23.36	23.46	—	—	± .218	2-1/8-8	4000



NOTE:

1. These torque values are approximate for steel bolts with lubricated threads.
2. Bolts should be held from rotating while the locknuts are torqued to the values shown.
3. *These locknuts are cad plated.

NOTE: All bolt threads should be lubricated. A clean motor oil is recommended.

Do not torque any locknuts at this time. Remove the disc pack alignment bolt if used. Now pivot the pack around until it lines up with the rest of the bolt holes in the hub. Install the rest of the hub bolts through the hub bolt holes, disc pack, washers, and locknuts. The remaining bolts for this end can be put through the center ring bolt holes, disc pack, washers, and locknuts. The locknuts can be snugged up at this time. The disc pack installed should look flat and parallel with the mating hub and center ring fingers.

4. Now proceed to the other end of the coupling. Remove the support bolts, if used, supporting the center ring in one of the other ways. Using paragraph "VI.B.3" above install the second disc pack to the hub. The remaining bolts for this end can now be installed. These bolts go in from the hub side first through the washer, the disc pack and then the bolt hole in the center ring adding the locknut. The locknuts can be snugged up at this time. The disc pack as installed should look flat and parallel with the mating hub and center ring fingers.

5. Make the final coupling alignment check at this time.

6. Torque up the locknuts. See Table 1 for torque values.

It is recommended that all locknuts be retightened after several hours of initial operation.

7. For further help with the installation or alignment, consult Rexnord.

NOTE: It may be necessary to use an open end wrench to torque the locknuts at the hub end due to the lack of room.

7. For further help with the installation or alignment, consult Rexnord.

VII. Disc Pack Replacement. If it becomes necessary to replace the disc pack, it can be done as follows:

- A. At the hub end of the coupling, remove all locknuts and washers. Back out and remove all but one bolt. It may be necessary to tap the ends of the bolts with a soft hammer to start them out. Pivot the disc pack out. Put one of the coupling bolts through the pack securing it with a locknut. This will keep the discs together and maintain the disc orientation for later reinstallation if reused. Remove the last bolt and slide the pack out.

B. For the CMR coupling

1. Remove the bolts that hold the flywheel adapter to the flywheel. Remove the adapter, disc pack, center ring assembly and put it on a bench.
2. Remove all the locknuts, washers, and bolts that hold the center ring to the disc pack. Remove the center ring. Before removing the disc pack, put a bolt through the pack and secure with a locknut. Remove the rest of the locknuts, washers, and bolts.

3. Replace parts as necessary. Recheck alignment per Section V. Reassemble per Section VI.A.

C. For the AMR coupling

1. Now disassemble the other end per "VII.A" above being sure to support the center ring when taking out the last bolts. Remove the center ring.
2. Replace parts as necessary. Recheck alignment per Section V. Reassemble per Section VI.B.

VIII. FOR REPLACEMENT PARTS, see Table 2.

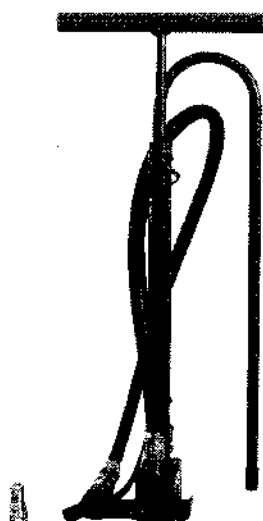
Table 2 Part Numbers and Quantity Required

Size of CMR Cplg.	FLYWHEEL ADAPTER	Hub	Center Ring	Disc Pack Two per Cplg.		Washer		Bolt		Locknut	
				Tom-aloy	Stainless	Part No.	Qty.	Part No.	Qty.	Part No.	Qty.
162	I PER COUPLING MADE TO CUSTOMER'S SPECIFICATIONS	811410	811050	710663	310663	002161	12	511049	12	916504	12
200		322058	120959	210665	710665	002170	12	211046	12	316505	12
225		622050	320960	210984	610984	002170	16	211046	16	316505	16
262		322047	720826	010965	210985	002167	16	110717	16	716506	16
312		021395	720752	010957	310957	002185	16	910966	16	116507	16
350		721392	820897	010952	010952	019098	16	310968	16	516508	16
375		921797	921373	410943	610943	019100	16	210924	16	916509	16
425		221838	321377	810986	010986	910928	16	210929	16	316510	16
450		122088	121376	210987	410987	710916	16	010917	16	716511	16
500		321936	920941	420735	620735	810919	16	310918	16	116512	16
550		021647	930642	110962	310962	910920	16	210921	16	516514	16
600		120943	837205	710959	910959	610901	16	910923	16	020253*	16
700		621073	830400	—	420803	910935	16	110936	16	020254*	16
750		622262	130596	—	921021	611079	16	811080	16	202055*	16
800		931467	330582	—	220851	710991	16	510990	16	020256*	16
850		531608	430458	—	020793	810978	16	610977	16	020257*	16
925	I PER COUPLING MADE TO CUSTOMER'S SPECIFICATIONS	002228	002232	—	020968	011043	16	713897	16	813898	16
1000		002216	002220	—	721034	411083	16	211082	16	112543	16
1100		002222	002226	—	421151	311167	16	111166	16	212014	16
1200		002235	002240	—	521630	002237	16	511627	16	412015	16
1300		008671	015983	—	411734	008674	16	511735	16	412015	16

*These locknuts are cad plated.

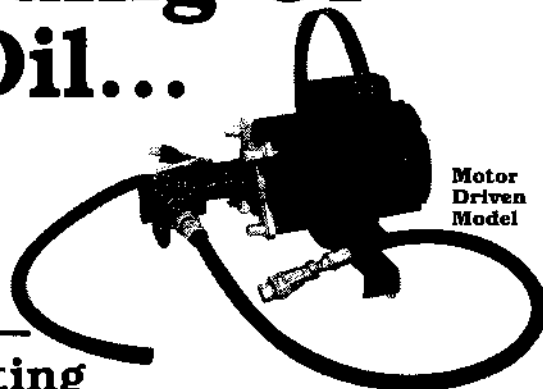


For further assistance, call Rexnord Corp. Coupling Operation, Warren, PA — 814-723-6600
FAX - 814-726-1740



For Easy Adding Of Crankcase Oil... Use The Vilter Oil Charger

**It's Ideal For Reciprocating
And Screw Compressors**



Is adding oil to the compressor crankcase a "headache" for you? Are you tired of the oil mess on the floor and worrying about oil contamination and air getting into the compressor? If so, how would you like one simple hand pump that will:

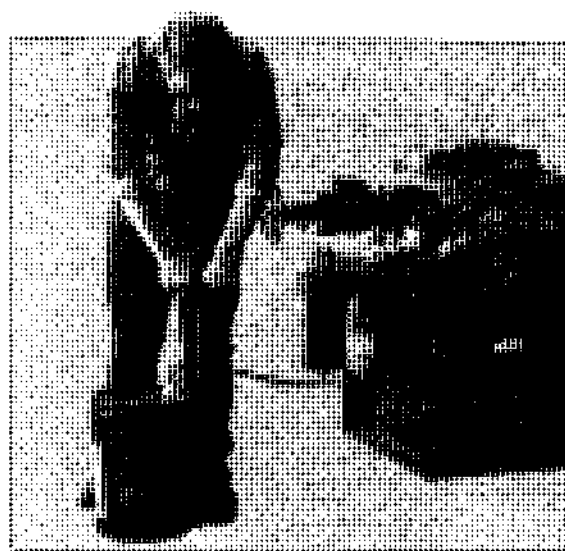
- Introduce oil into the crankcase *quickly, cleanly, and efficiently.*
- Charge oil separators.
- Charge oil lines and the seal chamber before starting the compressor.
- Flush the oilways in the crankshaft.

Vilter has offered such a pump, called the Oil Charger, since 1957.

With this simple easy-to-operate pump it takes only about 16 strokes to add a quart of oil. In addition, with the Vilter Oil Charger there is:

- No interference with compressor operation because the oil can be added any time, as long as the crankcase pressure is below 100 psi.
- No danger of air being drawn into the compressor because the oil lines from the supply can to the crankcase always remain completely filled after priming.
- No oil drips on the floor when connecting or disconnecting the lines because the quick coupler instantly shuts off both the charging hose and crankcase adapter connection.
- No inconvenience in pouring oil from container to container because the oil is pumped directly from the refinery sealed can to the compressor.
- No oil contamination during storage because the seal cap protects the hose coupler end and the oil can remains closed after the pump is attached.

The Vilter Oil Charger is perfect for use with Vilter VMC® reciprocating compressors as well as Vilter Single Screw and Twin Screw compressors; in fact, for any refrigeration compressor with a closed crankcase. It can also be used for other applications such as adding oil to the seal chamber on liquid pumps. Multiple compressor installations are no problem since extra adapters are available.



It takes only a few seconds to make the coupler connections and begin pumping. The oil charger is suitable for reciprocating and rotary screw compressors.

The Vilter Oil Charger offers many outstanding construction features. The cylinder is made of steel hydraulic fluid line tubing for easier pumping and no oil leakage. The two plunger cups are of die formed Neoprene, and fit the cylinder exactly for high pressure pumping. The hose is of reinforced Neoprene with a working pressure of 125 psi. The quick coupler is all steel, not brass, and designed for refrigeration service. The check valves are also of all steel construction. In short, each component is designed for easy operation and a long working life.

The Vilter Oil Charger can make your job a lot easier, so call your nearby Vilter District Office or Distributor today.

**See Back Side For Information On
Vilter's Motor Driven Oil Charger**



Charge 1½ gallons of Crankcase Oil a minute under pressure

with the Vilter Motor Driven Oil Charger

It's Ideal For Reciprocating And Screw Compressors

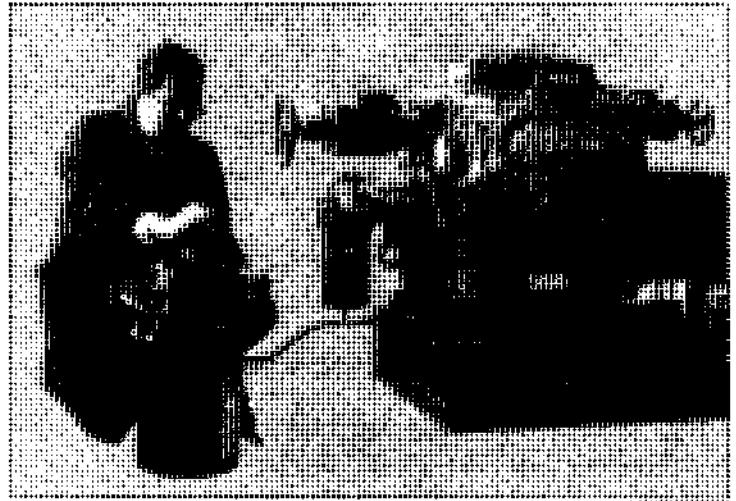
The addition of oil to a compressor crankcase under pressure is usually accomplished in either one of two different ways. One means is to pipe an oil can containing a fine mesh screen to the oil drain valve. The suction valve is then closed creating a partial vacuum and the oil drain valve is cracked to draw oil into the crankcase. The biggest disadvantage of this method is the disruption of the system which results when the suction valve is closed. Great care must also be taken to prevent the contamination of the oil or the entrance of air into the compressor during the operation. In addition, continued use of this procedure results in untidy engine room floors.

The other alternative is to use a hand pump to charge the oil into the crankcase. This is a considerable improvement since it does not disrupt the system, keeps air from entering the crankcase, prohibits any contamination of the oil and eliminates the untidiness of the operation. However, it can be a strenuous and time consuming procedure, particularly when a large charge has to be added to a crankcase or an oil separator.

But there is a third method of charging oil into a compressor under pressure — an extremely effective method requiring an absolute minimum of effort and time.

It's through the use of the Vilter Motor Driven Oil Charger. With the flick of a switch, oil is delivered from a refinery sealed can into the crankcase at the rate of 1½ gallons per minute against a maximum discharge pressure of 100 psi. At this rate, a Vilter reciprocating compressor crankcase can be filled in less than 5 minutes.

A motor driven pump is mounted on a bracket assembly which enables it to be easily attached to a 5 gallon can of compressor lubricant simply by tightening a thumb screw. The bracket is also formed to provide a convenient carrying handle for movement throughout the compressor room. Connection to the compressor is just as rapid since a quick coupling two-way shut-off attachment is



used. This means no opportunity for oil drips on the floor. When the coupling is snapped apart, both the charging hose and the adapter connection in the crankcase are instantly shut off.

The Vilter Motor Driven Oil Charger has been designed to give many years of trouble-free service. A 1½ H.P., 115 volt motor is used to drive the pump. An on-off switch is located in the motor terminal block and an 8 ft. long cord and plug set is furnished. The motor can also be supplied for 220 volt operation if desired.

Suction and discharge hoses are of reinforced Neoprene with a working pressure of 125 psi. The quick coupler is all steel, designed for refrigeration service.

The Vilter Motor Driven Oil Charger is ideal for use with Vilter VMC® reciprocating compressors, as well as Vilter Single Screw and Twin Screw compressors. In fact, it can be used on any refrigeration compressor having a closed crankcase.

It is especially appropriate for multiple compressor installations. Extra adapter kits, which include a bushing, nipple and the plug portion of the coupling, are available to enable the operating engineer to install a set in the oil charging valve of each compressor. As a result, a tedious, messy job that used to require hours to perform, is quickly and effectively finished in minutes.

Contact your nearby Vilter District Office or Distributor. He is prepared to give you immediate service and will be happy to provide any additional information you may require.

VILTER MANUFACTURING CORPORATION
5555 SOUTH PACKARD AVENUE
P.O. BOX 8904
CUDAHY, WISCONSIN 53110-8904
TELEPHONE (414) 744-0111
FAX (414) 744-3483



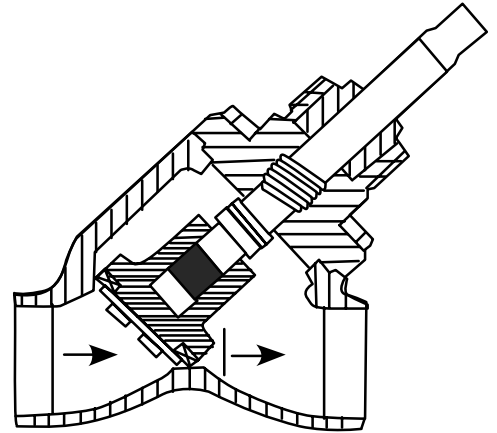
Bulletin No. 9641
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Vilter Stop/Check-Valve General Information

AUTO

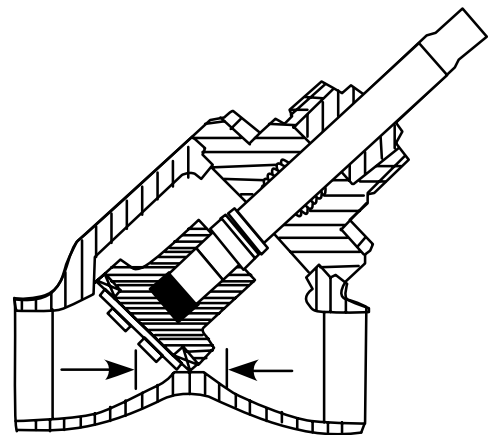
In the “Auto Position”, the stop valve is operating as a check valve, allowing flow in the directions of the arrows.

To set the valve to the automatic position, fully close the valve, and turn the stem out as indicated by the chart below.



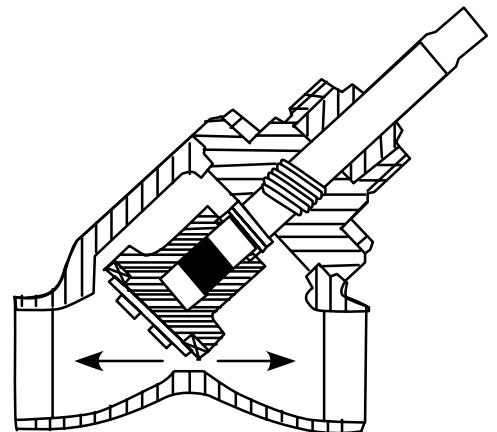
CLOSED

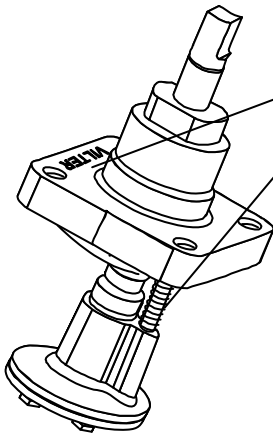
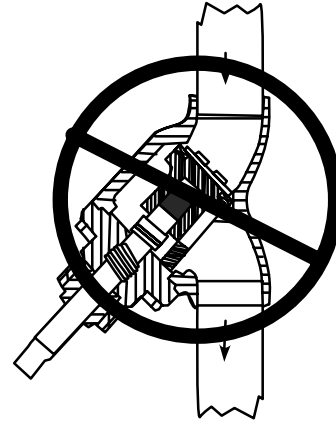
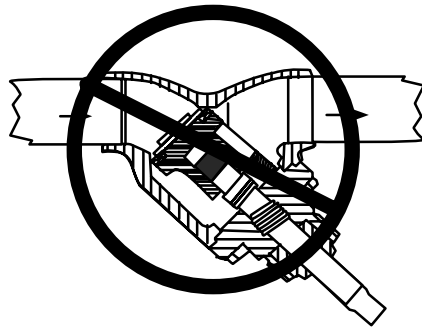
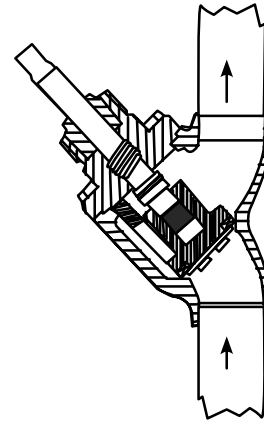
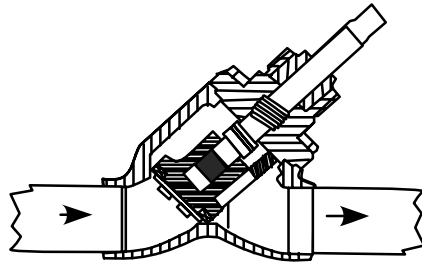
In the manually “Closed Position”, the stop check is operating as a conventional stop valve, not allowing flow in either direction.



OPEN

In the manually ” Open Position”, with the valve stem fully back seated, the valve disc is lifted slightly, allowing flow in either direction.





Verify the location of Spring and note the direction of the Vilter name

Installation:

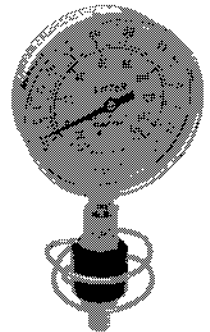
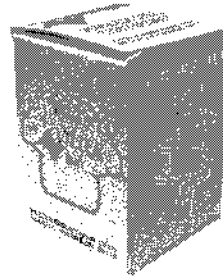
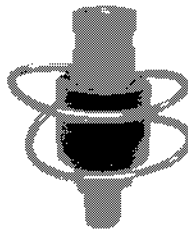
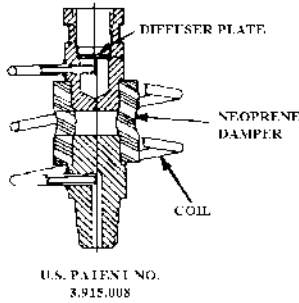
The new design will apply only to the 2" thru 4" stop valves. Retrofitting a field installation will require replacing the bonnet assembly.

The bonnet must be installed with the spring towards the bottom (see illustrations above). The drill fixture is designed so that the hole for the spring will always be drilled on the opposite side from the cast in Vilter name on the bonnet. From the outside of the valve, the casting numbers must always be towards the top of the valve.

VILTER MANUFACTURING CORPORATION

VILTER STEDY-MOUNT®

(New improved all stainless steel "Pulse Control" model)



Temperature And Pressure Application Range

Stedy-Mounts are factory-tested for service within an ambient temperature range of -50°F to $+150^{\circ}\text{F}$, and are suitable for *system temperatures* up to 300°F and system pressures up to 300 psig. For applications from 300 to 7000 psig, consult the Vilter Home Office.

If you want to use the Stedy-Mount for applications under pressure limitations governed by Codes other than ANSI/ASHRAE 15 Safety Code For Mechanical Refrigeration, Vilter will be glad to test the Stedy-Mount for your specific pressure requirement.

Installation And Servicing

Before installing, the Stedy-Mount should be checked to make sure the coil spring has not been compressed.

THE FULL BENEFITS OF A STEDY-MOUNT INSTALLATION WILL NOT BE ACHIEVED IF THE FITTINGS STRIKE EACH OTHER DURING OPERATION.

It is of extreme importance that the upper and lower coil fittings be separated by a space of $\frac{5}{16}$ " when the Stedy-Mount stands free, before the gauge is screwed into place.

Since this $\frac{5}{16}$ " space is enclosed within the Neoprene damper and is not visible, it cannot be measured directly. However, it can be checked by measuring the overall free length of the unit. If the Stedy-Mount measures exactly 3" overall, the air gap or space between fittings is exactly $\frac{5}{16}$ " as required.

If there is less than $\frac{5}{16}$ " air gap or free movement, the fittings can be pulled apart by hand to slightly overstretch the coil and then compressed again to obtain the required air gap (or 3" overall free unit length). When heavier gauges are used, it may be necessary to slightly increase the air gap by overstretching the coil to allow more than a $\frac{5}{16}$ " air gap.

Because periodic recalibration is necessary for all types of pressure gauges, it is suggested that the Stedy-Mount be installed downstream of a globe valve to facilitate safe removal of the pressure gauge.

Materials Of Construction

The "standard" VSM-1 Vilter Stedy-Mount consists of:

- 1 - Lower Coil Fitting - 304 stainless steel for $\frac{1}{4}$ " FPT connection.
- 1 - Upper Coil Fitting - 304 stainless steel for $\frac{1}{4}$ " MPT connection.
- 1 - Spiral Tube Coil - 304 stainless steel.
- 1 - Damper - Neoprene (oil resistant).
- 1 - Diffuser - 316 stainless steel.

Gauge Sizes And Weights

Because the Stedy-Mount converts the gauge into a free-standing, free-floating body, certain size and weight limitations must be applied in order not to convert the unit into a top-heavy system in which the gauge would topple over. To some extent, gauge sizes and weights are dependent on the make and pattern of the gauge.

Generally speaking, pressure gauges of $3\frac{1}{2}$ " dia. or less and weigh up to $2\frac{1}{2}$ lbs., or $4\frac{1}{2}$ " dia., weighing up to 2 lbs., can be accommodated by the Stedy-Mount. This is providing that the Top Heavy Moment of the weight of the gauge is within the 30 to 140 range. TOP HEAVY MOMENT is the product of the weight of the gauge (ounces) times the distance (inches) from the center of gravity of the gauge to the top of the Stedy-Mount. The center of gravity of the gauge must be low enough so the system does not lose its vertical stability.

STEDY-MOUNT

VILTER PART NO.	GAUGE CONNECTION	STEDY-MOUNT PIPE SIZE	TOP-HEAVY MOMENT RANGE (Oz.-In.)
A17311SS	$\frac{1}{4}$ "	$\frac{1}{4}$ "	30 - 140

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

OPERATION SECTION

TABLE OF CONTENTS

<u>PAGE</u>	
1	COMBINATION UNLOADER AND CAPACITY CONTROL
1	Introduction
1	Gas Operating Unloader – Single Stage Compressor
1	Oil Operated Unloader 400 Series, Single Stage, Booster, Integral Two-Stage And All 300 Series Compressors
2	AUTOMATIC CONTROLS
3	Dual Pressure Switch
3	Oil Pressure Failure Switch
3	High Pressure Switch
3	Capacity Reduction
4	Oil Filter Differential Switch
4	WARM START PROTECTION SYSTEM
4	General Description
4	Tri-Micro® Full-Flow Oil Filter And Differential Oil Pressure Switch
4	SETTING THE CAPACITY REDUCTION CONTROL
5	Single Compressor System
5	Dual Compressor System
6	Two-Stage Compressor System (400 Series Only)
6	COMPRESSOR OIL SYSTEM
6	Description
7	Oil Regulating Valve (Adjustable Oil Relief)
7	1 st Stage Oil Drain Arrangement (Two-Stage Compressors Only)
8	INTERCOOLER AND DESUPERHEATER (TWO-STAGE COMPRESSORS ONLY)
8	Intercooler

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

OPERATION SECTION

ILLUSTRATIONS AND TABLES

<u>PAGE</u>	<u>FIGURE</u>	
2	1	TYPICAL OIL UNLOADING SOLENOID VALVE
10	2	TYPICAL ELECTRICAL SCHEMATIC
11	3	AUTOMATIC CONTROL CONNECTIONS TYPICAL SCHEMATIC
12	4	SCHEMATIC CAPACITY REDUCTION CONNECTIONS AND UNLOADER MECHANISM ARRANGEMENT - TWO STAGE COMPRESSOR ONLY
13	5	HIGH STAGE 2 THRU 6 CYLINDER FOR 400 SERIES COMPRESSOR CAPACITY REDUCTION ARRANGEMENT TYPICAL SCHEMATIC
14	6	HIGH STAGE 8 AND 12 CYLINDER COMPRESSOR FOR 400 SERIES CAPACITY REDUCTION ARRANGEMENT TYPICAL SCHEMATIC
15	7	HIGH STAGE 16 CYLINDER COMPRESSOR FOR 400 SERIES CAPACITY REDUCTION ARRANGEMENT TYPICAL SCHEMATIC
16	8	UNLOADING ARRANGEMENT SCHEMATIC 3, 5 AND 7 CYLINDER - 300 SERIES COMPRESSOR
17	9	UNLOADER ARRANGEMENT SCHEMATIC 4, 6 AND 8 CYLINDER - 300 SERIES COMPRESSOR
18	10	UNLOADING ARRANGEMENT SCHEMATIC 3, 4 AND 5 CYLINDER - 300 SERIES COMPRESSOR
19	11	UNLOADING ARRANGEMENT SCHEMATIC 6, 7 AND 8 CYLINDER - 300 SERIES COMPRESSOR
20	12	TYPICAL REFRIGERANT FLOW DIAGRAM FOR SIX AND TWELVE CYLINDER TWO- STAGE COMPRESSORS WITH DESUPERHEATER
21	13	TYPICAL REFRIGERANT FLOW DIAGRAM FOR SIX AND TWELVE CYLINDER INTEGRAL TWO-STAGE COMPRESSORS WITH INTERCOOLER
22	14	REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM SIX CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH INTERCOOLER
23	15	REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM SIX CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH DESUPERHEATER
24	16	REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM TWELVE CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH INTERCOOLER
25	17	REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM TWELVE CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH AMMONIA DESUPERHEATER
26	18	REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM TWELVE CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH HALOCARBON DESUPERHEATER
27	19	450XL WATER JACKET CONNECTIONS
28	20	450XL WATER MODULATING VALVE CONNECTIONS

<u>PAGE</u>	<u>TABLE</u>	
5	1	SINGLE COMPRESSOR RANGE & OPERATION
6	2	DUAL COMPRESSOR RANGE & OPERATION
29	3	320, 340, 350ES VMC COMPRESSOR MAXIMUM LIMITS
30	4	440 VMC COMPRESSOR MAXIMUM LIMITS
31	5	450 VMC COMPRESSOR MAXIMUM LIMITS
32	6	450XL VMC COMPRESSOR MAXIMUM LIMITS

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

I. COMBINATION UNLOADER AND CAPACITY CONTROL

A. Introduction

Vilter MultiCylinder Compressors (VMC®) 400 Series cylinder unloaders are supplied as either gas or oil actuated. The 300 Series cylinder unloaders are oil actuated only. Gas actuation is standard on all high stage compressors, except those equipped with 100% internal capacity reduction. Oil actuation is standard on all high stage compressors with 100% internal capacity reduction, all booster compressors and all two stage compressors. The method of unloading is determined by the solenoid valve connections; two tube connections indicate a two way solenoid and gas unloading, three tube connectors indicate a three way solenoid and oil unloading.

B. Gas Operating Unloader – Single Stage Compressor

The mechanism is spring loaded and actuated by an unloader piston. When the compressor is not operating, and suction and discharge are equalized on both sides of the piston, the yoke springs force the yoke lift ring and lift pins upward. This lifts the suction valve plate which unloads a bank of cylinders.

When the compressor is started, the suction pressure is high. This results in minimal or no pressure difference on the unloader piston. The unloading cylinders remain unloaded for the initial revolutions. After the initial revolutions, the suction pressure decreases and the discharge pressure increases, resulting in an increase in pressure difference across the unloader piston. When the pressure reaches 35 psi (241.32 kPa), the unloader piston will depress, reseating the suction valve plate, and loading the bank of cylinders.

The compressor remains loaded during normal operation. When suction pressure drops below normal set point, the pressure control is af-

ected. Pressure controls used for unloading are not standard low pressure switches. They have a low pressure range but the contact closes a circuit when pressure drops below a prescribed level. As pressure drops, the pressure control closes a contact and energizes the solenoid valve connected to a bank of cylinders. When the solenoid valve is energized, it opens a pipe connection direct to the suction of the compressor. This allows pressurized gas above the unloader piston to escape to suction. An equalized pressure condition is produced above and below the unloader piston, lifting the suction plates via the yoke springs, and unloading the bank of cylinders.

This cycle is repeated whenever the load fluctuates. While the solenoid valve is open, gas metered from the discharge is transferred into the suction, maintaining an unloaded condition.

If a compressor is used in a system where another compressor is operating, the pressure difference is already present so the suction plate remains lifted for a shorter period of time on startup. This assumes that each compressor has a discharge check valve. Without the check valve, the suction plate will not be lifted on start-up.

C. Oil Operated Unloader 400 Series, Single Stage, Booster, Integral Two-Stage And All 300 Series Compressors

The mechanism is spring loaded and actuated by an unloader piston. When the suction and oil pressures are equalized on both sides of the piston, the yoke springs force the yoke, lift ring and lift pins upward. This lifts the suction valve plate, which unloads the bank of cylinders.

The capacity control system is incorporated in the compressor and is actuated by oil pressure. Pressure is conveyed to three-way solenoid capacity control valves, and is used for the operation of the unloader assembly. When the compressor is started, the solenoid valves are

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

D. Oil Operated Unloader 400 Series, Single Stage, Booster, Integral Two-Stage And All 300 Series Compressors (cont'd)

de-energized. Oil travels through the cylinder covers into the unloader cylinders, producing a pressure build up. Pressure is directed into the cylinder of the unloader mechanism which forces the unloader piston downward. The yoke arms of the unloader assembly lowers the lift pins and seats the suction valve plate.

The operation is complete and the cylinders are fully loaded.

To unload the cylinder, the solenoid valve energizes and bleeds off the pressure in the unloader cylinder. Oil flows through the solenoid valve and into the compressor crankcase.

The capacity control system typically operates two cylinders. When single cylinder unloading is required, the lift pins are omitted from one liner in a cylinder bank and the unloader mechanism unloads one cylinder. By controlling the solenoid valve in the line connected to the single cylinder unloader, the capacity reduction of all sizes of Vilter VMC Compressors is obtained in one cylinder increments.

The minimum gas flow through a VMC Compressor of any size should never be less than 25% of the maximum unless special precautions are taken to ensure proper cooling.

NOTE:

Machines with 100% built-in capacity reduction require an oil cooler, crankcase thermometer and a timer to avoid running longer than 30 minutes unloaded, and a crankcase oil temperature thermostat if temperature exceeds 150°F (66.5°C).

The pressure differential between steps of capacity is limited by the minimum differential of the controlling device (i.e. pressure switch, microprocessor thermostat or other device). Stan-

dard compressors and condensing units are controlled by pressure switches.

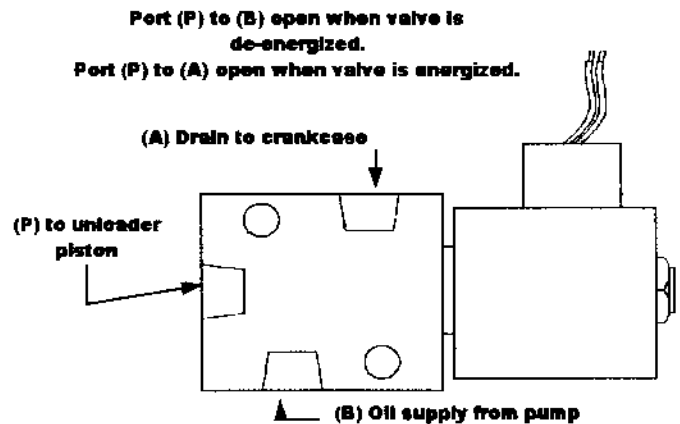


FIGURE 1. TYPICAL OIL UNLOADING SOLENOID VALVE

Capacity reduction solenoid valves are controlled electrically, and the device used to actuate the unloader solenoid valves are either temperature or pressure responsive depending upon the application type.

When standard unloading is used, capacity control solenoid valves are energized or de-energized in series. Controls are single pole, single throw and closes on a pressure or temperature drop.

Single step unloading alternates the single and double cylinder unloading mechanics. The capacity controls are wired to allow the double cylinder solenoid valve to de-energize while the single cylinder is energized and vice versa.

II. AUTOMATIC CONTROLS

Refer to Vilter Reciprocating Compressor Microprocessor Operating Manual for compressors equipped with a microprocessor control unit.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

A. Dual Pressure Switch

All Vilter VMC Compressors, except booster models and those controlled through microprocessors, are equipped with dual pressure switches. These switches protect the compressor from high excessive discharge pressures and excessively low suction pressures. The switches will open a set of contacts which stop the compressor whenever one of the previously mentioned conditions occur.

If the low pressure side contacts open, they close automatically when the pressure reaches a level sufficient for the cut-in setting. However, if the high side pressure contacts open, they must be reset manually. This is an indication of a major malfunction occurring in the system. The contacts cannot be reset until the pressure drops below the cut-in setting.

The cut-in and cut-out set points should be set on the low pressure side. On the high pressure side, set the cut-out point only. The differential between cut-in and cut-out is factory set at 5 psig (34.47 kPa). Refer to manufacturer's instruction sheets for further information.

B. Oil Pressure Failure Switch

A standard feature on each Vilter VMC Compressor (except those controlled through a microprocessor) is an oil failure switch that measures useable pressure available for lubrication. If, or when, the oil pressure drops below the prescribed levels, the pressure switch automatically shuts down the compressor. Useable oil pressure is a combination of the crankcase pressure and oil pump pressure. The switch senses oil pressure by using a pair of bellows. The first bellows identifies oil pump pressure. Another bellows, which is connected directly opposite the first, measures crankcase oil pressure. Each switch has a 90 second time delay to prevent nuisance failures. If the failure switch detects any anomalies in the first 90 seconds, it will shut

the compressor down. The switch must be manually reset after an oil failure.

C. High Pressure Switch

All booster compressors, models 2 through 8 cylinders are equipped with one high pressure switch. Twelve and sixteen cylinder machines have two switches because of the double discharge arrangement. The switches open on high pressure and reset automatically when discharge pressure drops. Cut-out set points are adjustable but the differential is factory set.

On the twelve and sixteen cylinder high stage machines, a single high pressure switch is used for the second discharge. The high pressure side of the dual pressure switch is connected to the other discharge. The high pressure switch has the same manual reset feature as the high pressure side of the dual pressure switch. Refer to the manufacturer's instructions located in this manual.

D. Capacity Control

This control operates the unloaders and has a single pole double throw action. A rise in pressure will signal an increase in capacity. The unloader control opens the contacts from red to blue colored terminals and closes the contacts from red to white colored terminals. This de-energizes the unloader solenoid valve and loads the compressor. The opposite action occurs when the pressure drops.

The differential of the control is fixed at approximately 2.5 psi (17.24 kPa) and is not adjustable. Set the control to close the contacts from red to white at the desired capacity control cut-in pressure. Once the single pointer is set at the correct pressure setting, the differential is subtracted from this setting. The resulting value is the point at which the contacts close from red to blue.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

E. Oil Filter Pressure Differential Switch

This switch is installed on compressors equipped with the optional "warm start" oil protection system. The switch is set to cut-out automatically when 40 psi (275.79 kPa) pressure differential is produced across the oil filter. The switch contact is normally closed when high oil pressure is not present.

When the 40 psi (275.79 kPa) oil pressure is produced across the filter, the contact opens and stops the compressor. If the compressor stops due to high filter differential, manually reset the filter oil differential switch before restarting the compressor. The switch reset button is located on the front of the control.

III. WARM START PROTECTION SYSTEM

CAUTION

Never attempt to start the VMC Compressor equipped with this system when the lube oil is too cold!

A. General Description

Some Vilter VMC Compressors incorporate an optional "warm start" oil protection system. This option features a differential oil pressure control across the inlet and outlet of a special Tri-Micro® (micronic-type) oil filter.

Any effort to start a VMC Compressor equipped with this feature when the lubrication oil is cold and viscous can result in extreme oil pressure build-up and severe pump damage.

Before initial starting of the compressor, and/or after a scheduled maintenance check, turn on the crankcase heater for an extended time period. The heater should remain on until the oil temperature has reached 100°F (37.8°C) (setting of thermostat equipped 400 Series crankcase heater). The 300 Series Compressor heater is not equipped with a thermostat. The

time frame for reaching the temperature will vary depending on the compressor location (indoors or outdoors). Special insulation may be necessary in unheated environments. Consult the factory.

B. Tri-Micro® Full-Flow Oil Filter And Differential Oil Pressure Switch

The Tri-Micro pressurized oil filter in the VMC Compressor is connected to a manual reset differential oil pressure switch (see paragraph II.E). The manual reset feature is provided to warn the operator when the oil filter element is dirty and to replace the recharge. Read the oil pressure differential across the Tri-Micro filter by alternately flipping the valve handle of the manual 3-way valve in opposite directions. Vilter strongly recommends the control setting on the filter oil pressure differential be checked by the operator prior to initial start-up of the compressor. Set the switch to provide a maximum of 40 psig (275.79 kPa) oil pressure differential across the filter.

On a new compressor, the filter element should be changed after 300 hours of break-in operation or whenever a gauge reading (taken on both sides of the filtering system) indicates a maximum pressure difference of 25 psig (172.37 kPa). Replace the filter element whenever the oil pressure drop across the filtering system reaches 25 psig (172.37 kPa), the compressor is opened for servicing, the filter is subjected to moisture, or whenever periodic oil checks reveal a gradual darkening of the oil.

IV. SETTING THE CAPACITY REDUCTION CONTROL

When setting the pressure controls for capacity reduction and unloading, consider the operating conditions. Under varying loads, the capacity reduction controls maintain predetermined suction pressure and reduce machine

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

IV. SETTING THE CAPACITY REDUCTION CONTROL (cont'd)

capacity to suit the conditions. Under constant load conditions, the capacity reduction control is not used to any great extent to unload the compressor to facilitate starting.

A. Single Compressor System

NOTE:

Pressures shown below are for example purposes only. PRESSURE RANGES AND OPERATING PRESSURES MUST BE BASED ON ACTUAL SYSTEM PARAMETERS.

To illustrate setting these controls on a fluctuating load, consider this hypothetical case:

A 30°F (-1.1°C) room with varying loads is maintained by a 6 cylinder VMC Compressor (three cylinder banks, one bank without capacity reduction).

Unloader control 'A' should be set to cut-out at 20 psig (137.9 kPa), control 'B' at 19 psig (131.00 kPa) and the low pressure action of the dual pressure section of the dual pressure switch should be set at 18 psig (124.11 kPa). These switches operate with a differential of 6 to 50 psig (41.37 to 344.74 kPa). The range and operation of each is as follows:

TABLE 1. SINGLE COMPRESSOR RANGE & OPERATION

Dual Pressure Switch	23 psig (158.58 kPa) Compr. Starts
Low Pressure Switch	18 psig (124.11 kPa) Compr. Stops
Control 'B'	24 psig (165.48 kPa) Loaded
One Bank of Cylinders	19 psig (131.00 kPa) Unloaded
Control 'A'	25 psig (172.37 kPa) Loaded
One Bank of Cylinders	20 psig (137.9 kPa) Unloaded

When the compressor is started, balanced pressures exist between the high side and low side,

and the two banks of cylinders are unloaded. It is assumed the compressor has been shut down a sufficient length of time for the pressure to equalize. After a short period, the pressure differential should be sufficient to operate the capacity reduction mechanism and the two banks of cylinders are loaded.

As suction pressure decreases to 20 psig (137.9 kPa) with a drop off of the load, control 'A' energizes a solenoid valve, and unloads the cylinder bank. As suction pressure decreases to 19 psig (131.00 kPa), control 'B' energizes a solenoid and unloads the cylinder bank.

If the load decreases and the suction pressure drops to 18 psig (124.11 kPa), the low pressure switch will enable and shut down the compressor.

When suction pressure decreases to 23 psig (158.58 kPa), the compressor starts, and one cylinder bank operates fully loaded (bank without capacity reduction). The two remaining cylinder banks are unloaded.

If the load increases suction pressure to 24 psig (165.48 kPa), control 'B' will operate and load a cylinder bank. An increase in suction pressure to 25 psig (172.37 kPa) loads the remaining cylinder bank. At this point, the compressor is operating at full capacity.

The preceding example describes a rapidly fluctuating load. In the case of loads that remain constant for long durations, the compressor could operate with one bank of cylinders cycling between loaded and unloaded position.

B. Dual Compressor System

NOTE:

Pressures shown below are for example purposes only. PRESSURE RANGES AND OPERATING PRESSURES MUST BE BASED ON ACTUAL SYSTEM PARAMETER.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

B. Dual Compressor System (cont'd)

When two Vilter VMC Compressors operate on one load, Vilter recommends both machines operate together.

As an example, two 6 cylinder VMC Compressors are running automatically on widely varying loads. Set the switches and controls as follows:

TABLE 2. DUAL COMPRESSOR RANGE & OPERATIONS

COMPRESSOR 1		
Low Pressure Switch	Control 'B' (Bank 2)	Control 'A' (Bank 1)
21 psig (144.79 kPa)	23 psig (158.58 kPa)	25 psig (172.37 kPa)
Cut-in	Loaded	Loaded
16 psig (110.32 kPa)	18 psig (124.11 kPa)	20 psig (137.9 kPa)
Cut-out	Unloaded	Unloaded
COMPRESSOR 2		
Low Pressure Switch	Control 'D' (Bank 2)	Control 'C' (Bank 1)
20 psig (137.9 kPa)	22 psig (151.69 kPa)	24 psig (165.48 kPa)
Cut-in	Loaded	Loaded
15 psig (103.42 kPa)	17 psig (117.21 kPa)	19 psig (131.00 kPa)
Cut-out	Unloaded	Unloaded

Assume the compressors have shut down because the suction pressure has dropped to its cut-out set point. When suction pressure increases to 20 psig (137.9 kPa), the low pressure switch starts compressor 2. One bank is loaded. The two remaining cylinder banks are unloaded. When pressure rises to 21 psig (144.79 kPa), compressor 1 starts with two cylinder banks unloaded. With an increase in suction pressure to 22 psig (151.69 kPa), control 'D' of compressor 2 loads a cylinder bank. A rise to 23 psig (158.58 kPa) loads bank 2 of compressor 1. As pressure rises to 24 psig (165.48 kPa), bank 1 of compressor 1 loads. At this point, both compressors are operating at full capacity.

A load decrease reduces the capacity of each compressor inversely:

Bank 1, compressor 1 unloads at 20 psig (137.9 kPa), bank 1, compressor 2 unloads at 19 psig (131.00 kPa), bank 2, compressor 1 at 18 psig

(124.11 kPa) and bank 2, compressor 2 at 27 psig (186.16 kPa). If suction pressure drops below 16 psig (110.32 kPa), compressor 1 shuts down. If suction pressure drops below 15 psig (103.42 kPa), compressor 2 shuts down.

C. Two-Stage Compressor System (400 Series Only)

Two-stage compressors are supplied as standard without capacity reduction but, 50% capacity reduction is available as an option. This is available for both the six cylinder and twelve cylinder models.

On the six cylinder compressor, two low stage (booster) cylinders and one high stage cylinder are unloaded, and on the twelve cylinder compressor, four low stage (booster) cylinders and two high stage cylinders are unloaded.

Both three way solenoid valves used for high stage unloading and for low stage (booster) unloading are wired in parallel so both the low stage booster and high stage are loaded and unloaded simultaneously. See Figure 4 for oil piping connections.

Oil pressure supplied by the compressor operates the unloading mechanisms located inside the compressor. In order to insure positive action of the unloading mechanism, the oil pressure on the machines should be at least 40 psi (275.79 kPa) above second stage suction pressure.

V. COMPRESSOR OIL SYSTEM

A. Description

The core of the VMC Compressor oiling system is an automatic, reversible gear type positive acting pump. The pump is compressor shaft driven. Oil is drawn into the pump through a fine mesh strainer from the crankcase reservoir.

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VILTER MultiCylinder Compressor

A. Description (cont'd)

The pump discharges oil through a pressurized micronic type filter into the seal end of the compressor. Oil enters the bottom of the seal chamber through an external connection and is flushed upward, under pressure, to provide the shaft seal with full flow cooling. Excess oil, bypassed by relief, leaves at the top of the chamber.

Drilled oilways in the crankshaft conduct high pressure oil from the chamber to the various crankpin bearings. Cylinders are lubricated by oil thrown from the crankpin and wristpin oil bearing. The shaft roller bearings receive their oil through metering orifices in the bearing covers.

In a refrigeration system using Vilter VMC Compressors, an external pressure float valve is used in conjunction with a Vilter standard oil separator to facilitate oil return. Oil is returned through a 1/4" (6.35 mm) line directly into the crankcase of the compressor via NPT tapped boss on the suction end of the compressor frame.

B. Oil Regulating Valve (Adjustable Oil Relief)

The oil pressure regulating valve on the 400 Series VMC Compressor is located in the front bearing housing of the machine. The regulating valve on the 300 Series is located in the rear bearing housing. It consists of a spring loaded ball type valve positioned in the bearing housing. An adjusting screw regulates the pressure on the spring and ball. With less pressure on the ball, more oil bypasses the oil system and line pressure is low.

To adjust this valve, stop the compressor and remove the cap to expose the adjusting stem. Start the compressor and raise the oil pressure. To lower oil pressure, turn the screw counterclockwise.

NOTE:

The stem is designed so it cannot be backed out, provided the stuffing box packing and packing nut are not removed.

Adjust the oil pressure regulating valve to maintain a minimum of 45 to 50 psig (310.27 to 344.74 kPa) net oil pressure for 400 Series Compressors (oil pressure minus crankcase pressure equals net oil pressure). 300 Series Compressors require 60 psig (413.69 kPa) net oil pressure.

When oil pressure actuates the unloader mechanism, it is important to have net oil pressure in excess of 45 pounds net, to provide quick response of the unloader arrangement.

C. 1st Stage Oil Drain Arrangement (Two-Stage Compressors Only)

During compressor operation, any oil return with the suction gas usually accumulates in the 1st (low) stage suction manifold. Oil is drained automatically and returned to the compressor crankcase as follows:

As the oil settles in the suction manifolds of the two outside banks of the compressor, it drains by gravity through a check valve into the oil reservoir. The equalizing line between the oil reservoir and the 1st (low) stage suction is open through the three-way solenoid valve. When the oil level rises in the oil reservoir to the actuating level of the oil float switch, the solenoid valve is made to change ports. This action causes the oil reservoir's 1st (low) stage suction equalizing line to close and the line between the high stage discharge and oil reservoir to open. Simultaneously, the timer is energized. The discharge gas pushes the oil out of the reservoir, through a check valve and into the compressor crankcase. At the end of the time cycle, the solenoid valve reverts to the original position to allow for draining from the low stage suction.

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D. 1st Stage Oil Drain Arrangement (Two-Stage) Compressors Only (cont'd)

The cycle is continuously repeated as long as the compressor is running.

VI. INTERCOOLER AND DESUPERHEATER (TWO-STAGE COMPRESSORS ONLY)

A. Intercooler

The function of an intercooler in a two-stage compressor system is to remove the heat of compression from the first stage discharge gas before the gas enters the second stage cylinders, and to subcool the liquid from the condenser or receiver.

The intercooler is a horizontally mounted vessel consisting of an inner flooded vessel containing a tube bundle, through which liquid from the receiver is circulated, and a concentric outer vessel that receives the first stage discharge gas and gas-liquid mixture from the inner vessel. A thermostatic expansion valve controls the amount of superheat in the first stage discharge gas passing through the intercooler.

Liquid refrigerant, from the receiver, enters the tube bundle of the inner shell. A small amount of this liquid is bled off and metered through the thermostatic expansion valve to maintain a level, at intermediate pressure, in the inner flooded vessel. As the warm liquid passes through the tubes, it is subcooled by the lower temperature liquid in the inner shell. The heat absorbed by the liquid in the inner shell causes it to boil. The resultant gas-liquid mixture is then piped into the first stage discharge lines leading to the outer shell, and is mixed with the first stage discharge gas.

The first stage discharge gas is desuperheated by mixing with the cooler gas-liquid mixture, by the subsequent boiling off of the liquid contained in this mixture from the inner vessel, and by contact with the relatively cool outside surface of

the inner shell. The desuperheated gas from this outer shell is fed into the second stage cylinders, where it is compressed and discharged into the condenser.

The thermostatic expansion valve bulb is located at the outlet of the intercooler (second stage suction line), where it senses the temperature of the leaving gas, adjusts the flow of refrigerant into the flooded inner vessel, and controls superheat to the second stage.

A subcooler, or intercooler, should not be installed in the high pressure liquid line before the two-stage compressor intercooler. This is to avoid excessive thermostatic expansion valve feed due to work not being done in the compressor intercooler.

CAUTION

Periodic interruption of the liquid feed to the intercooler should be avoided, especially if a float switch control is used on the evaporator. This can result in excessive hunting of the intercooler thermostatic expansion valve, resulting in possible liquid carry-over to the second stage cylinders.

Higher capacities are obtained with an intercooler than with a desuperheater if the effect of the subcooled liquid is used to the best advantage. Certain operational pitfalls must be avoided so the advantage gained by subcooling the liquid is not lost.

The liquid line from the intercooler must be insulated or the liquid will pick up heat as it passes through a warm room and the resultant efficiency could be lower than if no subcooling were provided. The intercooler, and the line from the intercooler to the compressor, should be insulated. Factory insulation of the intercooler and intercooler line consist of layers of sheet insulation.

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VILTER MultiCylinder Compressor

A. Intercooler (cont'd)

NOTE:

Liquid line and intercooler insulation results in more efficient operation, and eliminates problems caused by dripping condensate. If factory insulation is not ordered, we strongly recommend insulation be applied at time of installation.

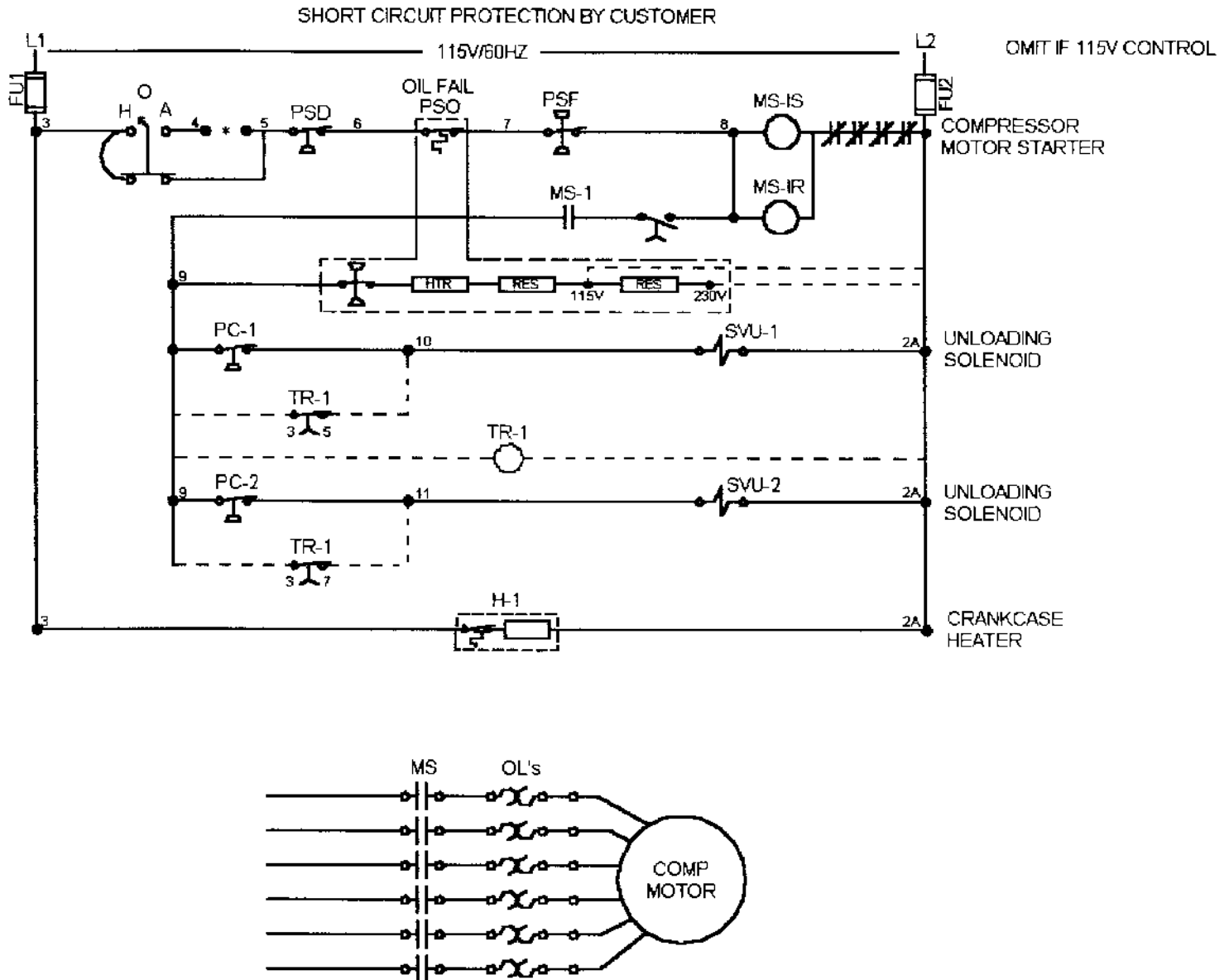
If the subcooling feature of the two-stage intercooler is not desired, or subcooling is provided elsewhere in the system, a desuperheater, which desuperheats the gas from the low stage without subcooling liquid refrigerant from receiver, is available in place of the standard intercooler.

The operation of the desuperheater is very similar to the intercooler. The refrigerant gas from the low temperature evaporator enters the compressor through the low stage suction connection, and is compressed to the intermediate pressure. The gas is then discharged into each end of the desuperheater, where it is desuperheated. It then enters the high stage cylinders through the outlet connection of the desuperheater. The gas is compressed to discharge conditions, and directed to the compressor.



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VILTER MultiCylinder Compressor



MS	MAGNETIC STARTER
FU	FUSE
SW	SWITCH HAND-OFF-AUTO
PSD	PRESSURE SWITCH - DUAL
PSO	PRESSURE SWITCH - OIL
PC	PRESSURE CONTROL - UNLOADER
SVU	SOLENOID VALVE UNLOADER
TR	TIMER - UNLOADED START
H	CRANKCASE HEATER
PSF	FILTER DIFFERENTIAL PRESSURE SWITCH

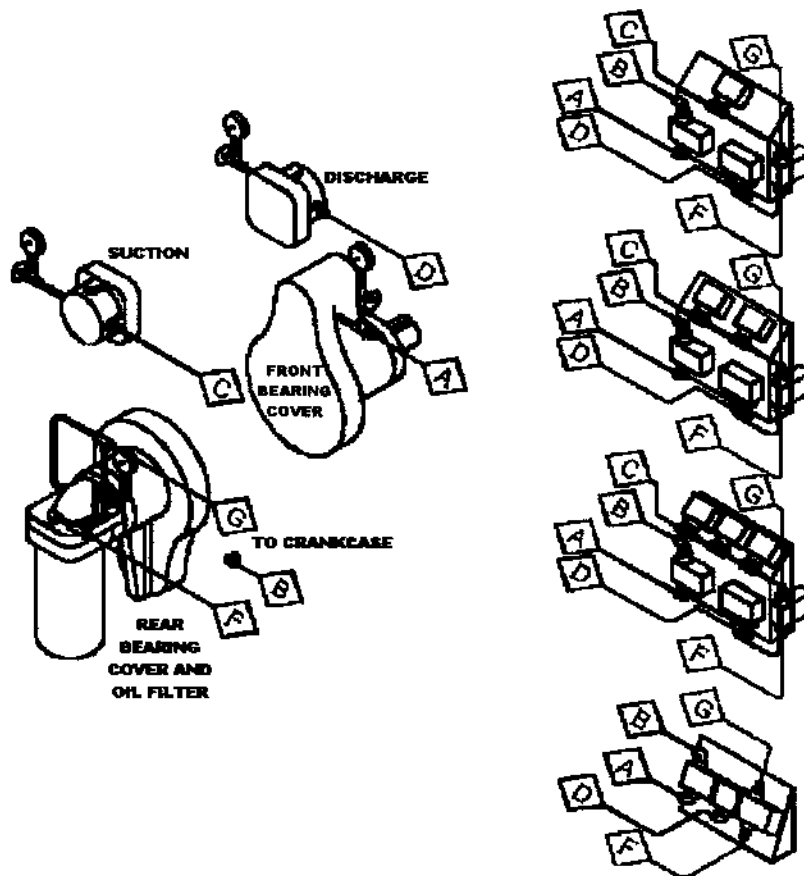
NOTES:

- 1) WIRING PER NEMA 12.
- 2) CONTROL WIRING #14 AWG JIC COLOR CODE UNLESS REPRESENTS FIELD WIRING.
- 3) DOTTED WIRING REPRESENTS FIELD WIRING.
- 4) DOTTED COMPONENTS NOT BY VILTER.
- 5) * DENOTES TERMINALS FOR CUSTOMER CONTROL OR INTERLOCK.
- 6) ● DENOTES TERMINAL IN VILTER CONTROL PANEL.


FIGURE 2. TYPICAL ELECTRICAL SCHEMATIC

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VILTER MultiCylinder Compressor



NOTES:

Control arrangements vary with compressor model and are pictured accordingly. Symbol  with letter inside indicates control connecting points. It ties a particular point to its corresponding point on compressor.

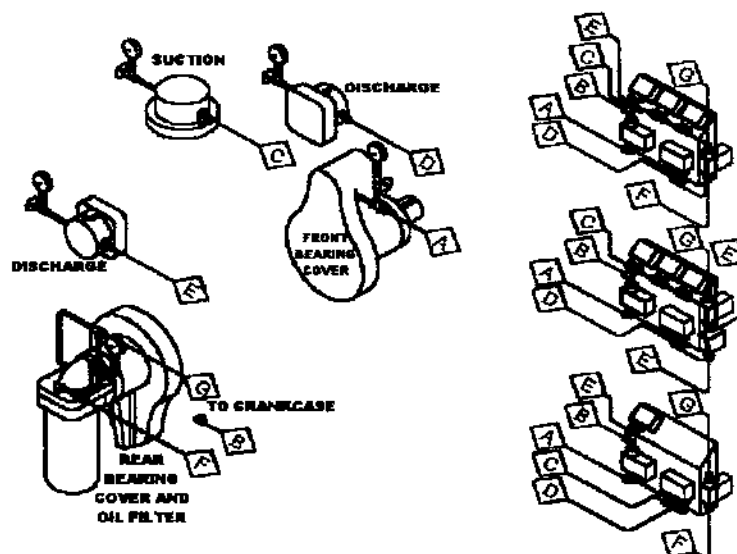
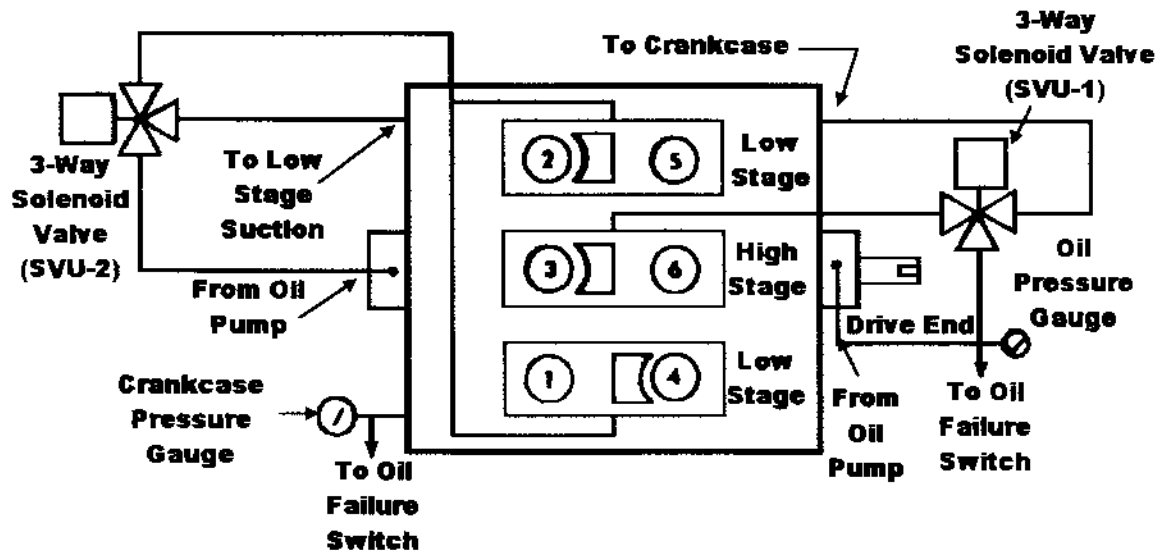


FIGURE 3. AUTOMATIC CONTROL CONNECTIONS TYPICAL SCHEMATIC

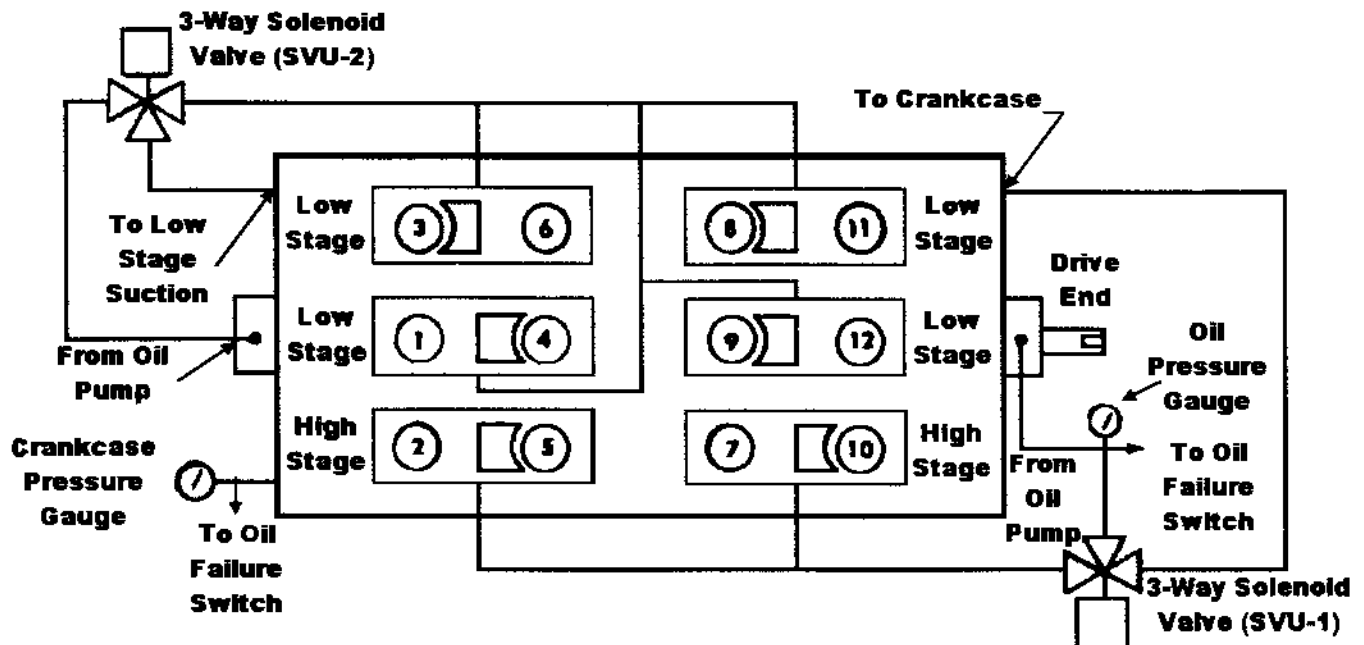
VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

6 CYLINDER COMPRESSOR WITH 50% CAPACITY REDUCTION OPTION



12 CYLINDER COMPRESSOR WITH 50% CAPACITY REDUCTION OPTION



NOTES:

- Number within a circle indicates arrangement sequence of connecting rods on crankshaft counting from compressor pump end. Also used to designate cylinder location.
- When solenoid valves are energized, the compressor is unloaded. When solenoid valves are de-energized, the compressor is loaded.
- = oil flow direction.

FIGURE 4. SCHEMATIC CAPACITY REDUCTION CONNECTIONS AND UNLOADER MECHANISM ARRANGEMENT – TWO STAGE COMPRESSOR ONLY

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

KEY TO SCHEMATIC

Number indicates arrangement sequence of connecting rods on crankshaft counting from compressor pump end. Also, used to designate cylinder location.

Denotes double cylinder unloading mechanism for a particular cylinder bank.

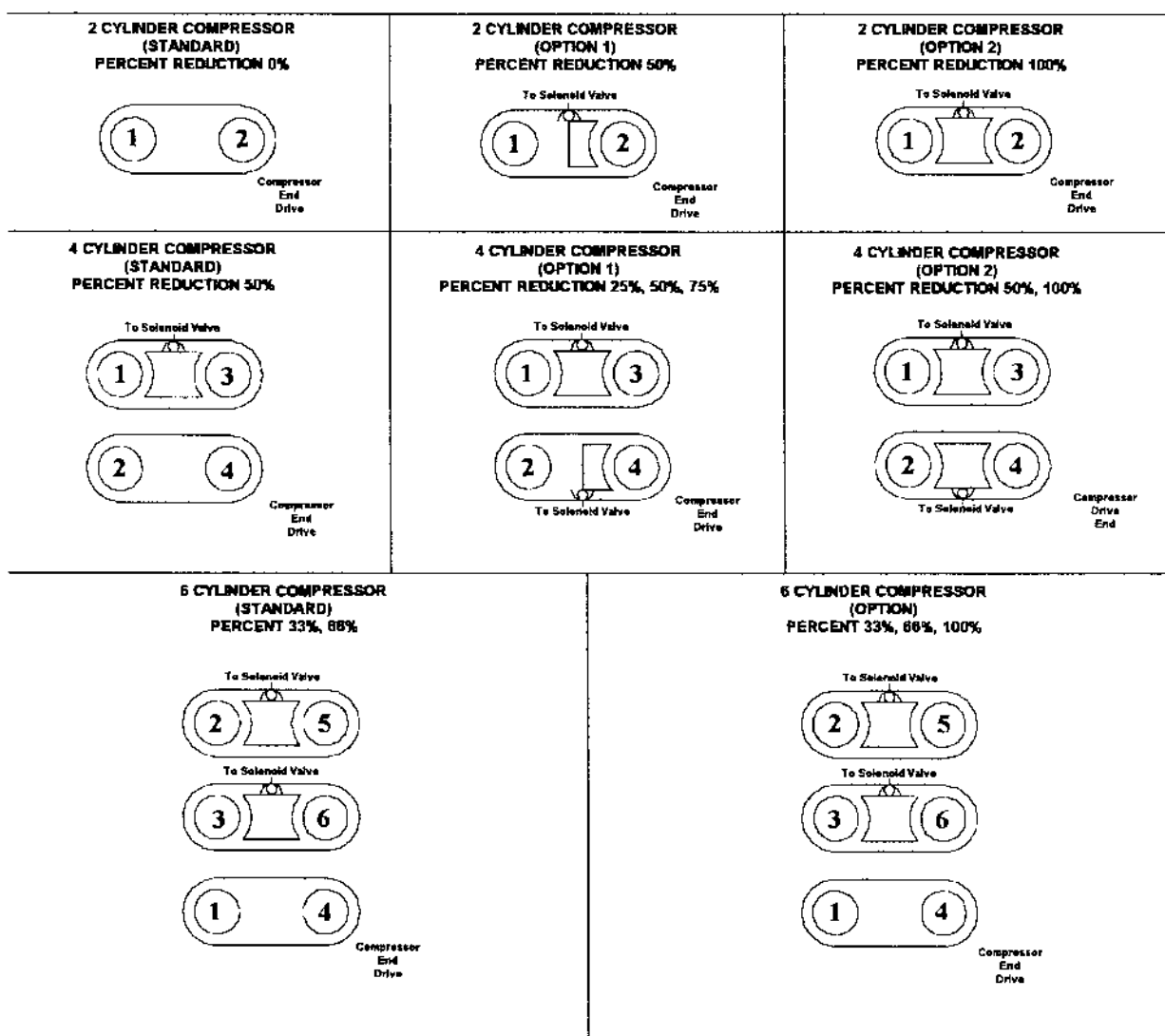
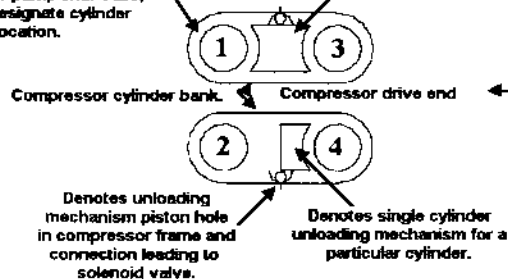
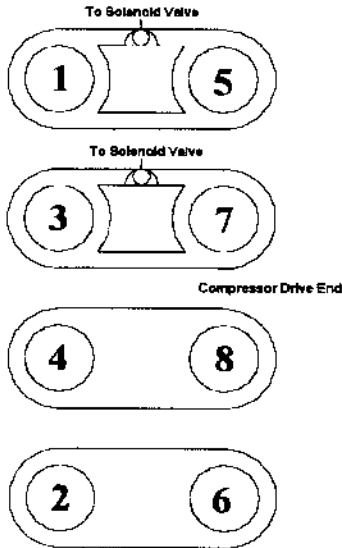


FIGURE 5. HIGH STAGE 2 THRU 6 CYLINDER FOR 400 SERIES COMPRESSOR CAPACITY REDUCTION ARRANGEMENT TYPICAL SCHEMATIC

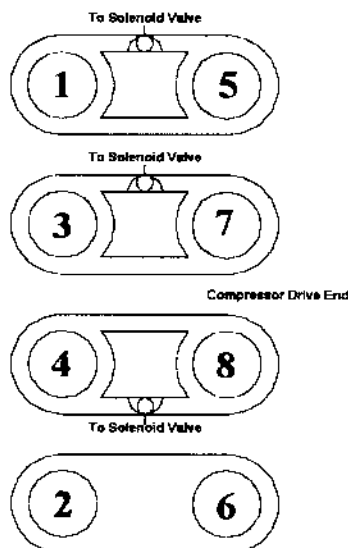
VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

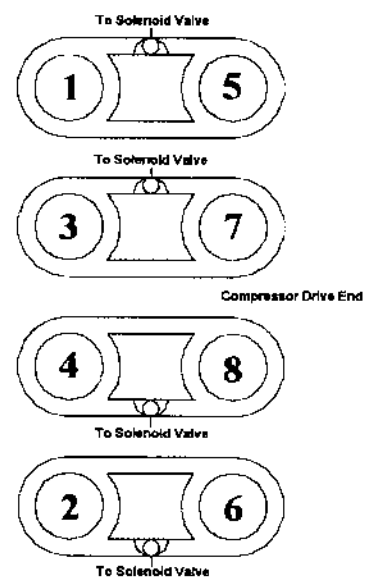
8 CYLINDER COMPRESSOR (STANDARD) PERCENT REDUCTION 25%, 50%



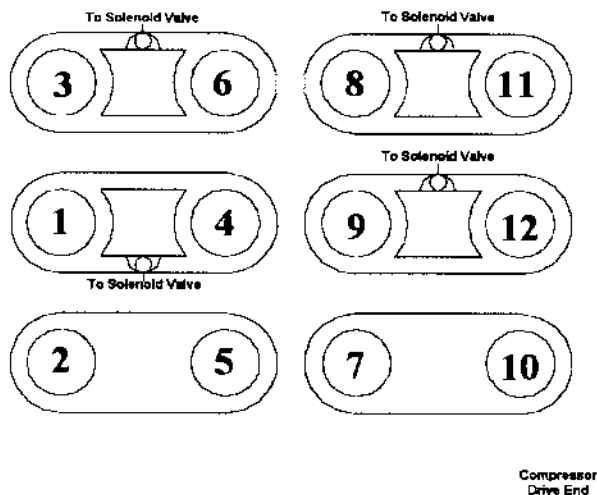
8 CYLINDER COMPRESSOR (OPTION 1) PERCENT REDUCTION 25%, 50%, 75%



8 CYLINDER COMPRESSOR (OPTION 2) PERCENT REDUCTION 25%, 50%, 75%, 100%



12 CYLINDER COMPRESSOR (STANDARD) PERCENT REDUCTION 33%, 66%



12 CYLINDER COMPRESSOR (OPTION) PERCENT REDUCTION 33%, 66%, 100%

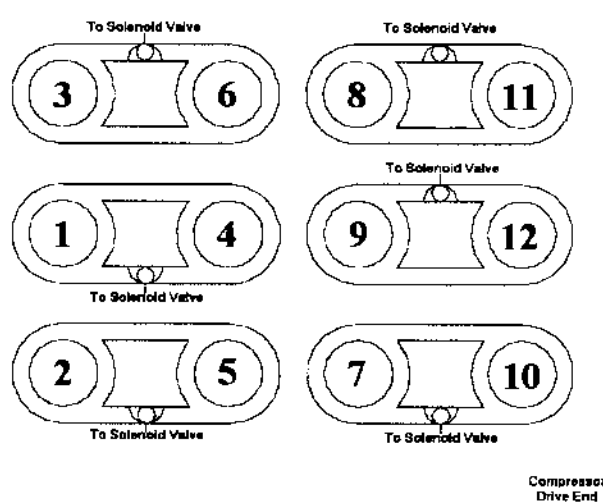
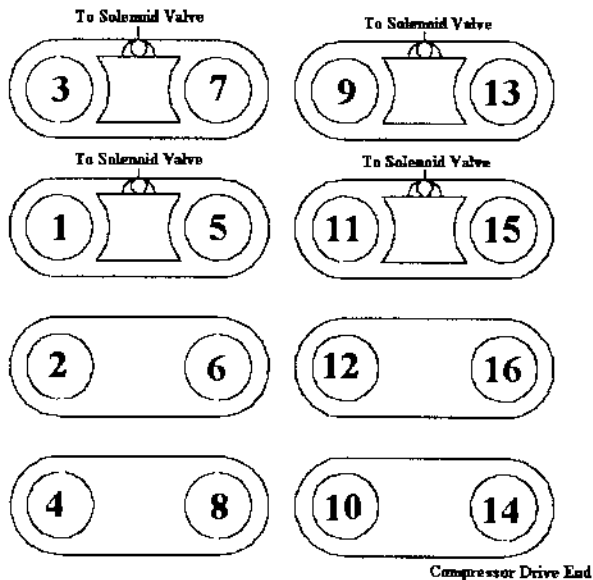


FIGURE 6. HIGH STAGE 8 AND 12 CYLINDER COMPRESSOR FOR 400 SERIES
CAPACITY REDUCTION ARRANGEMENT TYPICAL SCHEMATIC

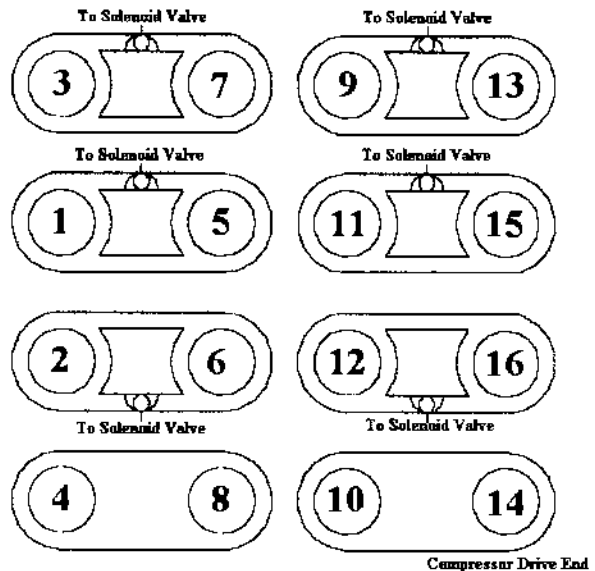
VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

16 CYLINDER COMPRESSOR (STANDARD) PERCENT REDUCTION: 25%, 50%



16 CYLINDER COMPRESSOR (OPTION 1) PERCENT REDUCTION: 25%, 50%, 75%



16 CYLINDER COMPRESSOR (OPTION 2) PERCENT REDUCTION: 25%, 50%, 75%, 100%

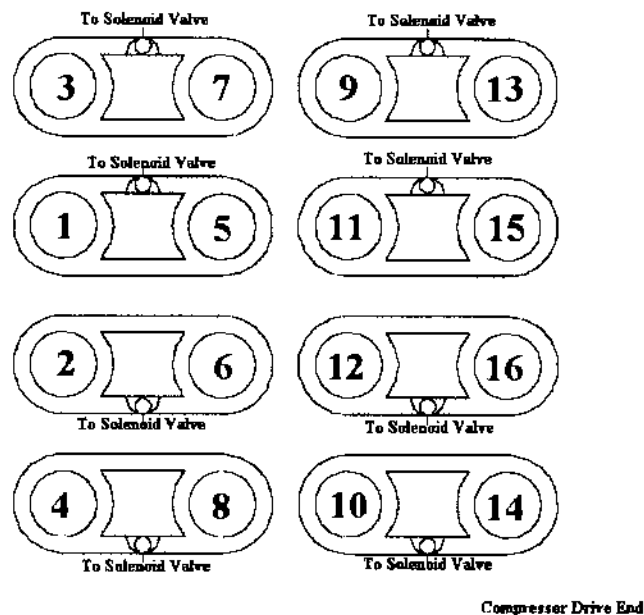


FIGURE 7. HIGH STAGE 16 CYLINDER COMPRESSOR FOR 400 SERIES
CAPACITY REDUCTION ARRANGEMENT TYPICAL SCHEMATIC

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VILTER MultiCylinder Compressor

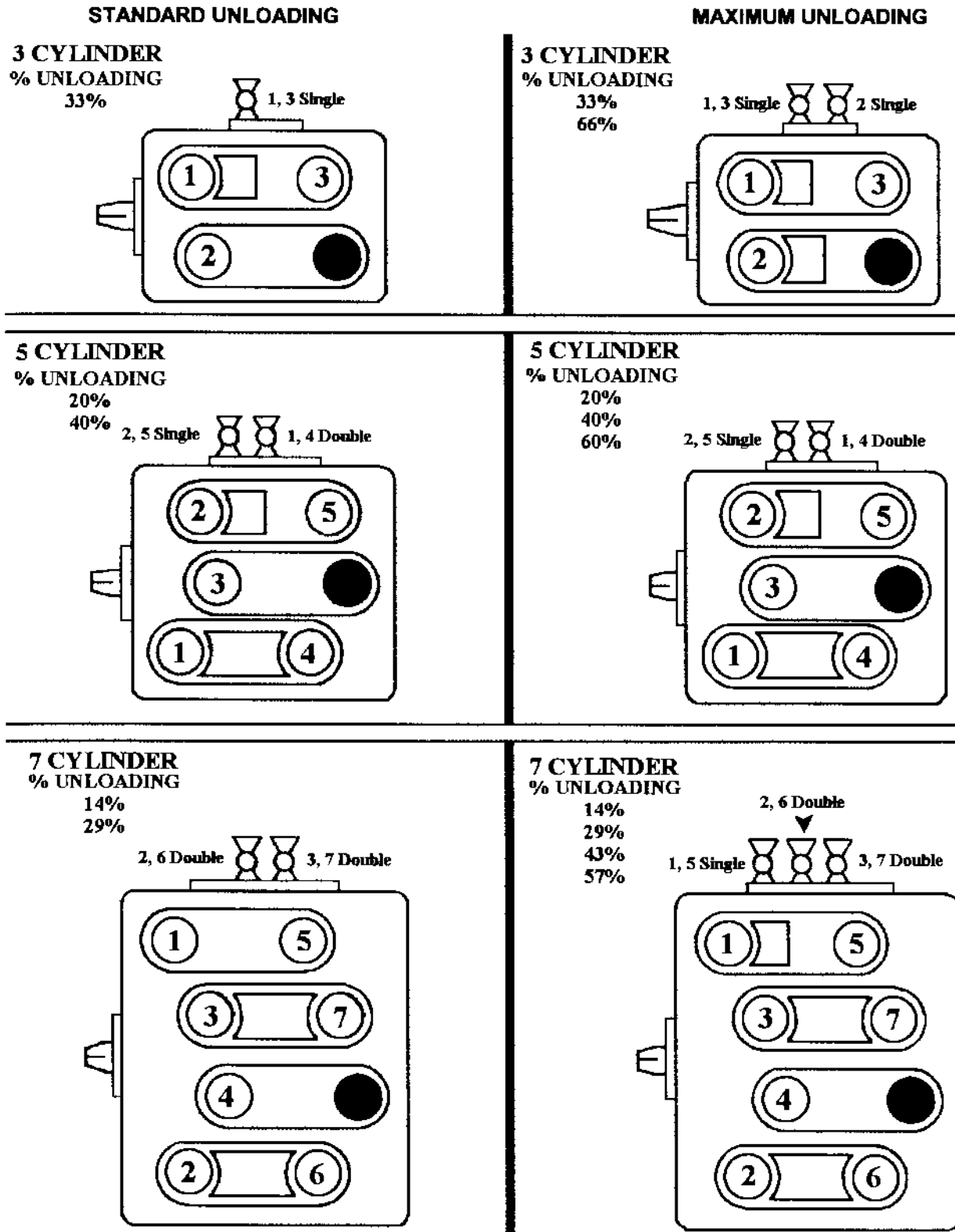


FIGURE 8. UNLOADING ARRANGEMENT SCHEMATIC
3, 5 AND 7 CYLINDER 300 SERIES COMPRESSORS

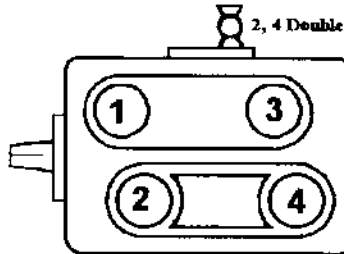
VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

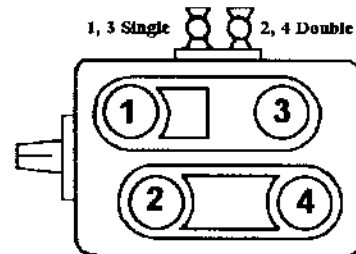
STANDARD UNLOADING

MAXIMUM UNLOADING

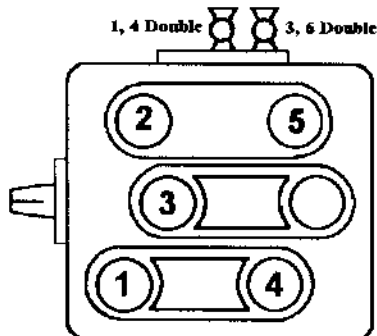
4 CYLINDER
% UNLOADING
50%



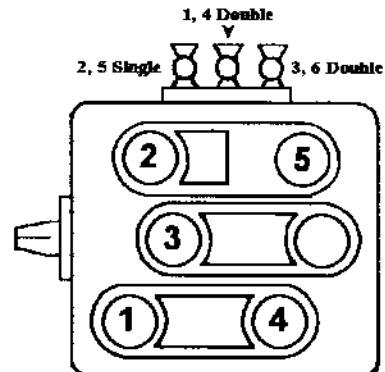
4 CYLINDER
% UNLOADING
25%
50%
75%



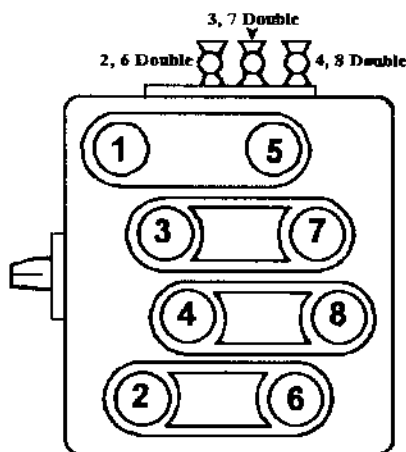
6 CYLINDER
% UNLOADING
33%
66%



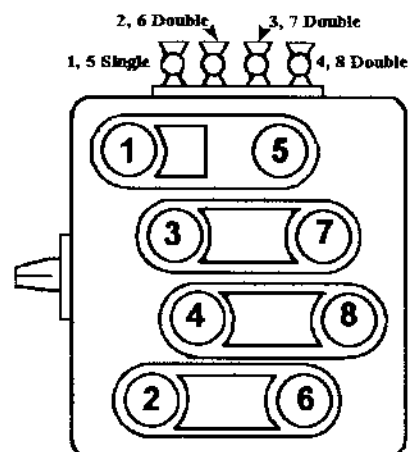
6 CYLINDER
% UNLOADING
17%
33%
50%
66%



8 CYLINDER
% UNLOADING
25%
50%
75%



8 CYLINDER
% UNLOADING
12%
25%
37%
50%
62%
75%



**FIGURE 9. UNLOADER ARRANGEMENT SCHEMATIC
4, 6 AND 8 CYLINDER 300 SERIES COMPRESSORS**

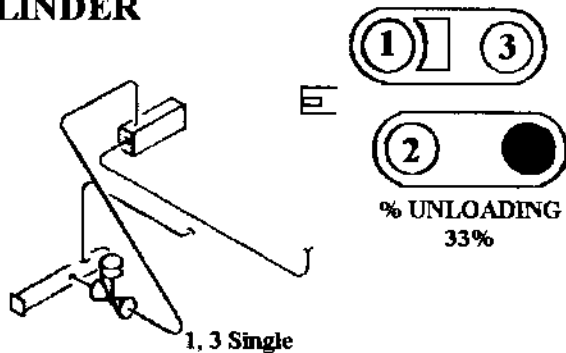
VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

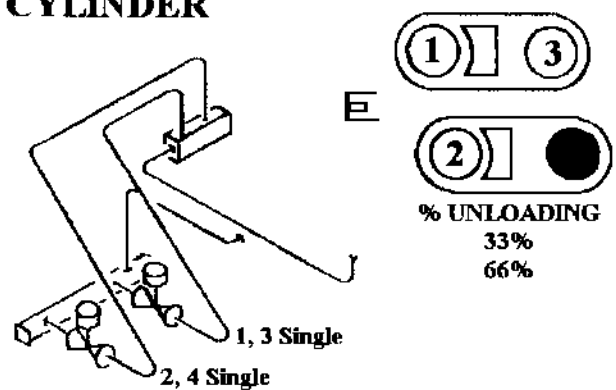
STANDARD UNLOADING

MAXIMUM UNLOADING

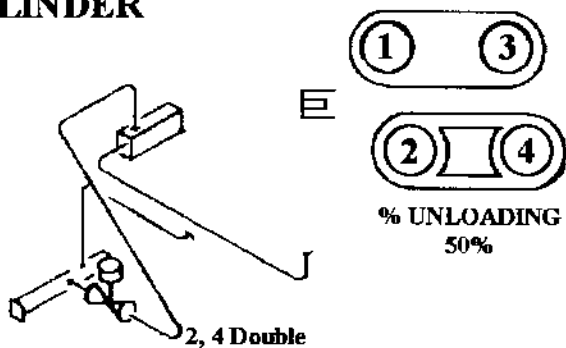
3 CYLINDER



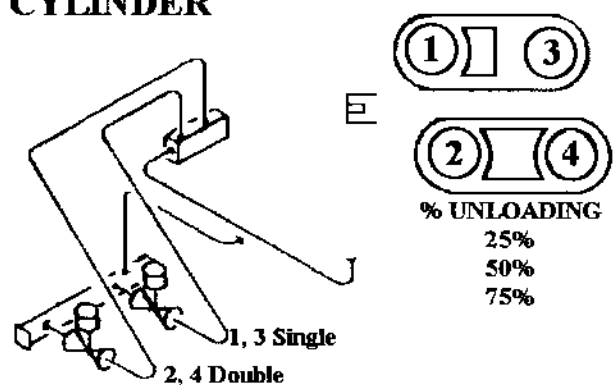
3 CYLINDER



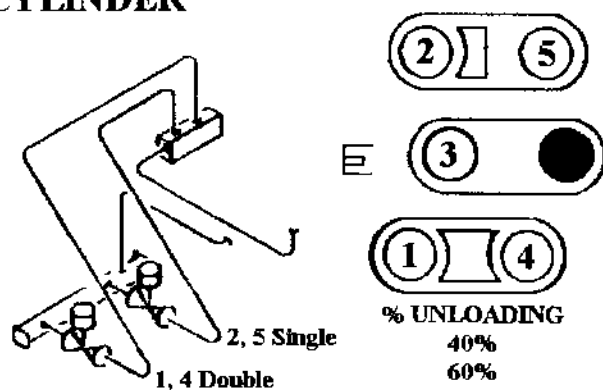
4 CYLINDER



4 CYLINDER



5 CYLINDER



5 CYLINDER

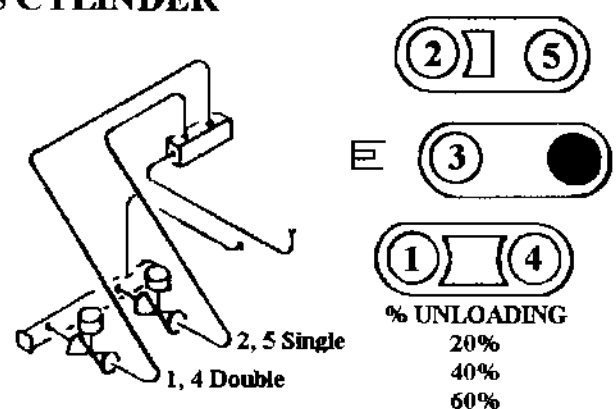


FIGURE 10. UNLOADING ARRANGEMENT SCHEMATIC
3, 4 AND 5 CYLINDER 300 SERIES COMPRESSORS
(Class 1 Group D Division II Explosion Proof Units)

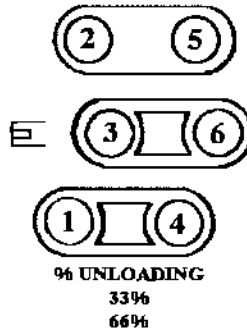
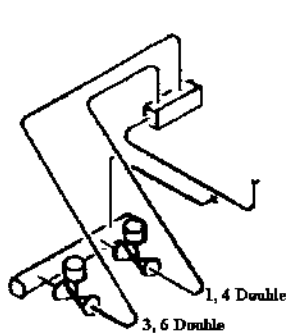
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VILTER MultiCylinder Compressor

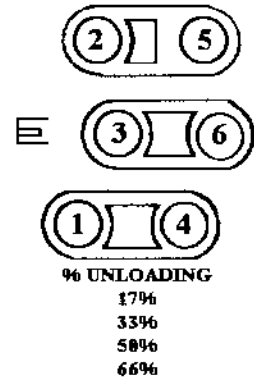
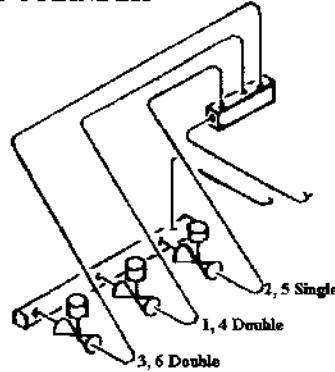
STANDARD UNLOADING

MAXIMUM UNLOADING

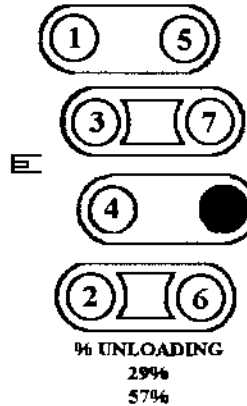
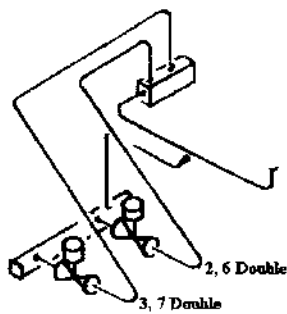
6 CYLINDER



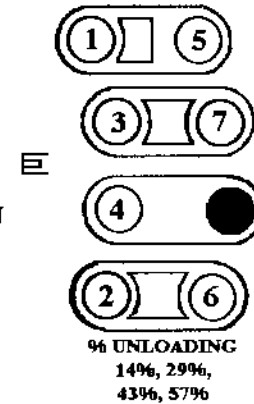
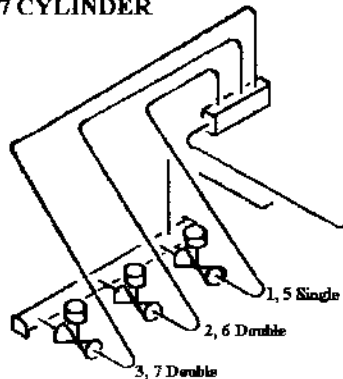
6 CYLINDER



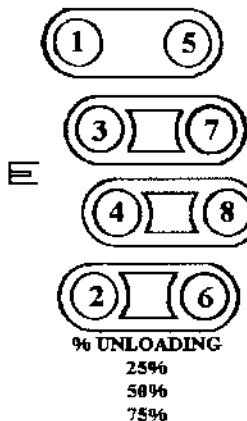
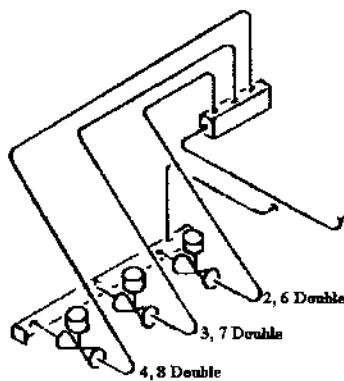
7 CYLINDER



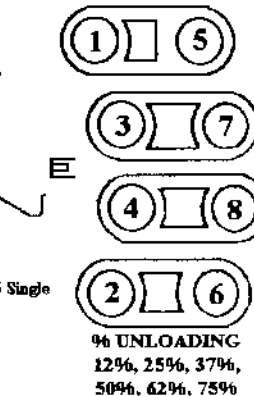
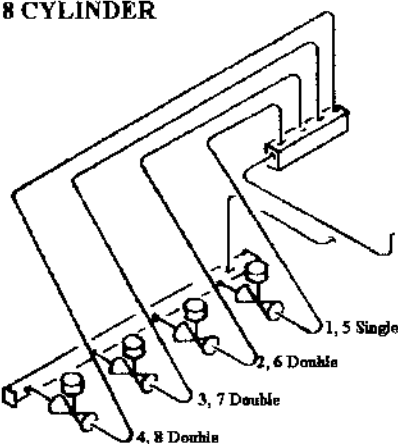
7 CYLINDER



8 CYLINDER



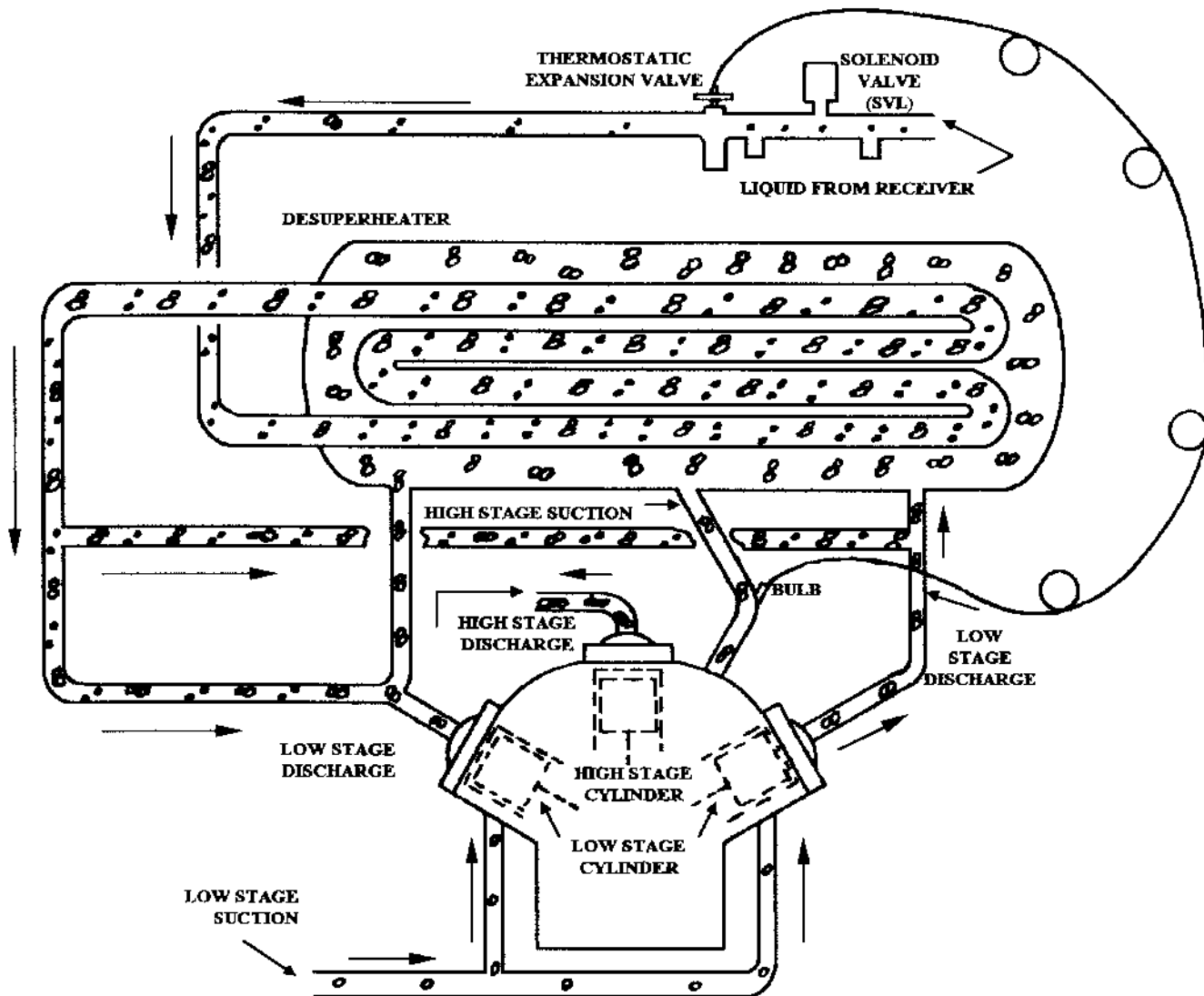
8 CYLINDER



**FIGURE 11. UNLOADING ARRANGEMENT SCHEMATIC
6, 7 AND 8 CYLINDER 300 SERIES COMPRESSORS
(Class 1, Group D, Division II Explosion Proof Units)**

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VILTER MultiCylinder Compressor



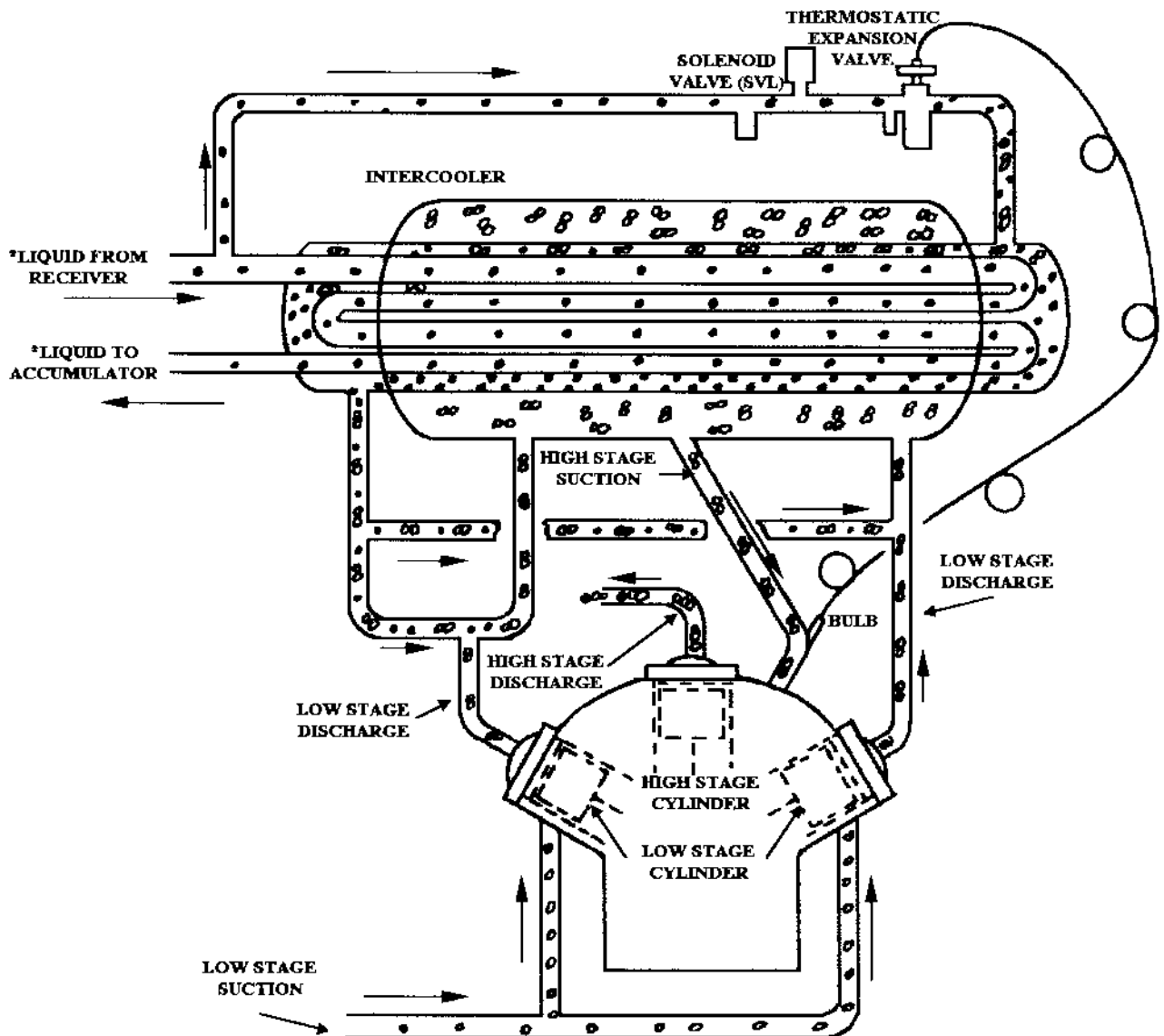
• • •	= INTERMEDIATE PRESSURE LIQUID
• • •	= HIGH PRESSURE LIQUID
○ ○ ○	= LOW STAGE SUCTION GAS
∞ ∞ ∞	= INTERMEDIATE PRESSURE GAS
∞ ∞ ∞	= HIGH STAGE DISCHARGE GAS

NOTE: 6 CYLINDER MODEL USING ANY REFRIGERANT SHOWN. 12 CYLINDER MODEL'S OPERATION IS SIMILAR

FIGURE 12. TYPICAL REFRIGERANT FLOW DIAGRAM FOR SIX AND TWELVE CYLINDER TWO-STAGE COMPRESSORS WITH DESUPERHEATER

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VILTER MultiCylinder Compressor



NOTE: 6 CYLINDER MODEL USING ANY REFRIG-
ERANT SHOWN. 12 CYLINDER MODEL OPERATION
IS SIMILAR.

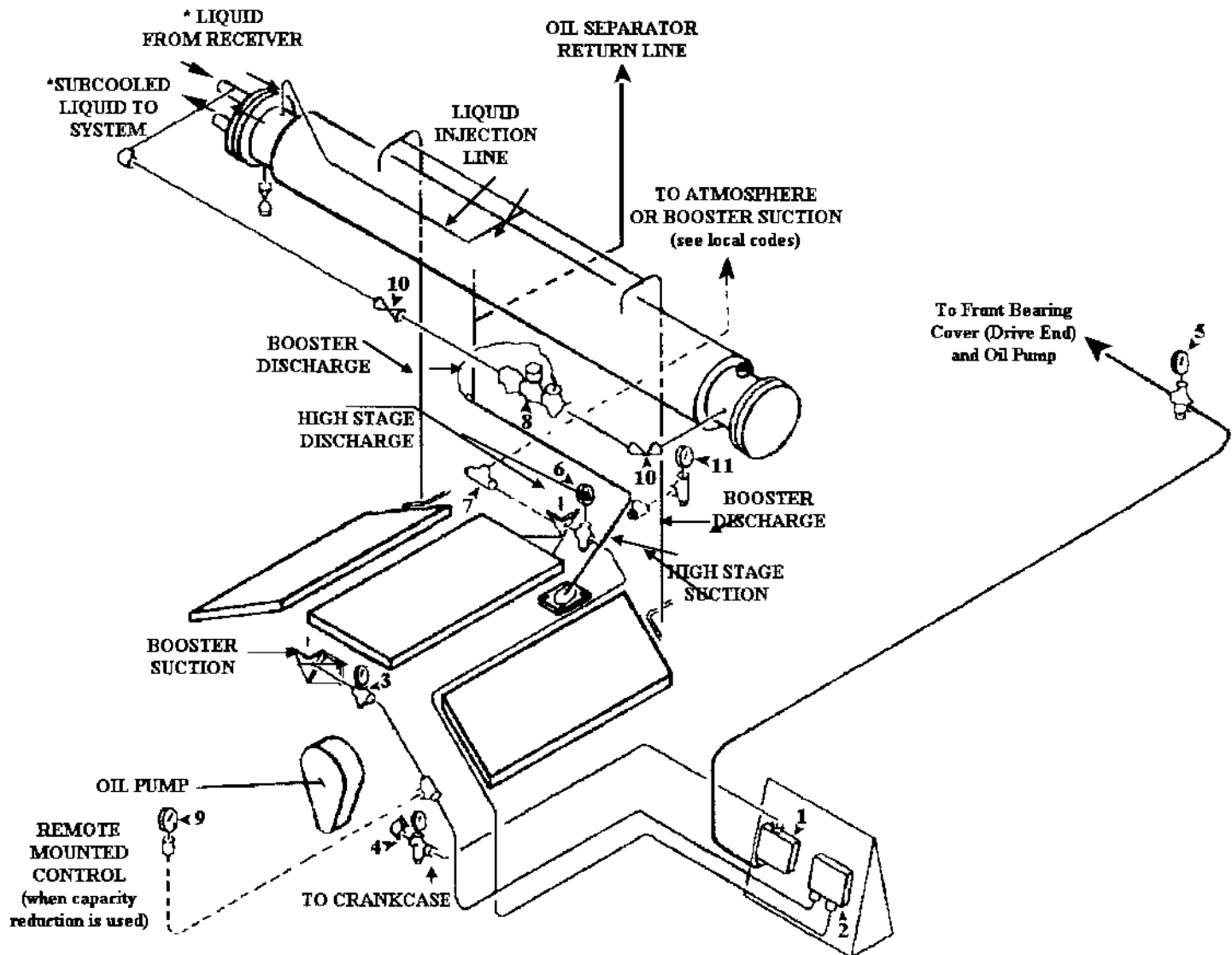
• • •	= INTERMEDIATE PRESSURE LIQUID
• • •	= HIGH PRESSURE LIQUID
○ ○ ○	= LOW STAGE SUCTION GAS
● ● ●	= INTERMEDIATE PRESSURE GAS
● ● ●	= HIGH STAGE DISCHARGE GAS

* If user installs stop valves in this line, pump down coil be-
fore closing valve or install relief valve. This will prevent pos-
sible rupturing of tubes when unit is shut down and warms up.

FIGURE 13. TYPICAL REFRIGERANT FLOW DIAGRAM FOR SIX AND TWELVE CYLINDER
INTEGRAL TWO-STAGE COMPRESSORS WITH INTERCOOLER

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor



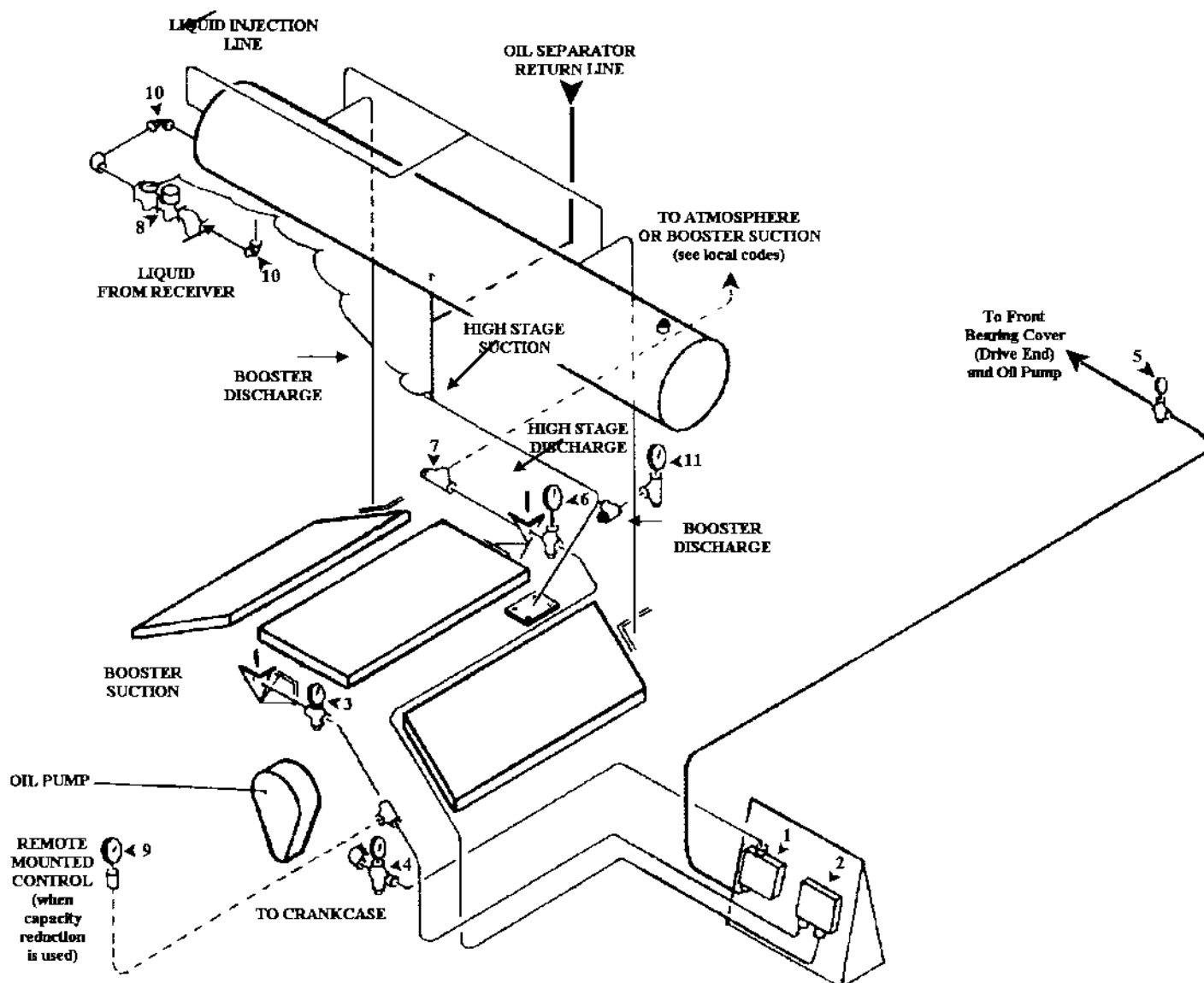
KEY

ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
1	Oil Pressure Failure Switch ("PSO")	7	Safety Valve Set @ 300 psig
2	Dual Pressure Switch ("PSD")	8	Thermostatic Expansion Valve, Solenoid Valve ("SVL") and Strainer Assembly
3	Low Pressure Gauge	9	Capacity Control Switch ("PC-1")
4	Crankcase Pressure Gauge	10	Liquid Line Valve (2)
5	Oil Pressure Gauge	11	Intermediate Pressure Gauge
6	High Pressure Gauge		

**FIGURE 14. REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM
SIX CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH INTERCOOLER**

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor



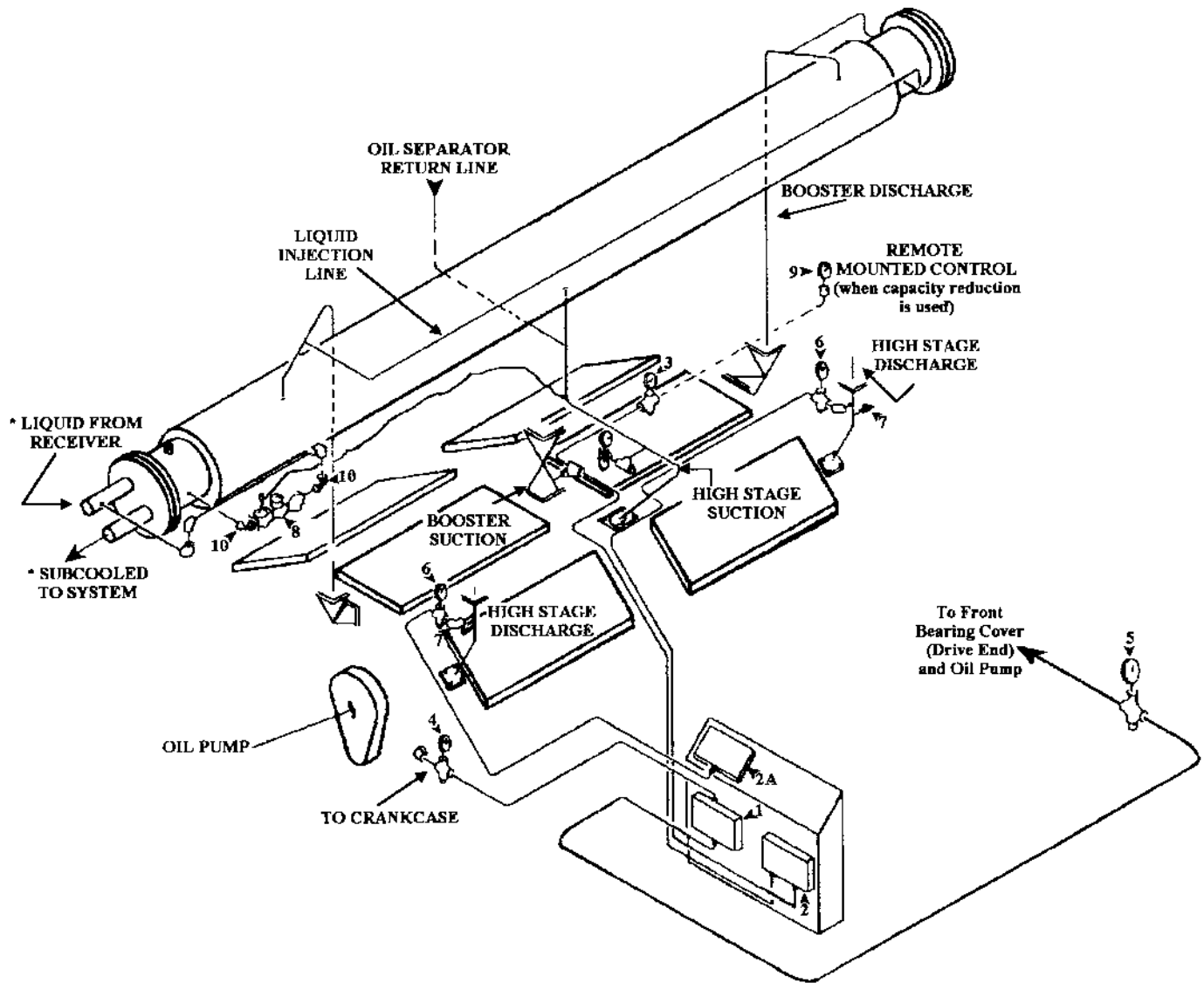
KEY

ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
1	Oil Pressure Failure Switch ("PSO")	7	Safety Valve set at 300 psig
2	Dual Pressure Switch ("PSD")	8	Thermostatic Expansion Valve, Solenoid Valve ("SVL") and Strainer Assembly
3	Low Pressure Gauge	9	Capacity Control Switch ("PC-1")
4	Crankcase Pressure Gauge	10	Liquid Line Valve (2)
5	Oil Pressure Gauge	11	Intermediate Pressure Gauge
6	High Pressure Gauge		

**FIGURE 15. REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM
SIX CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH DESUPERHEATER**

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor



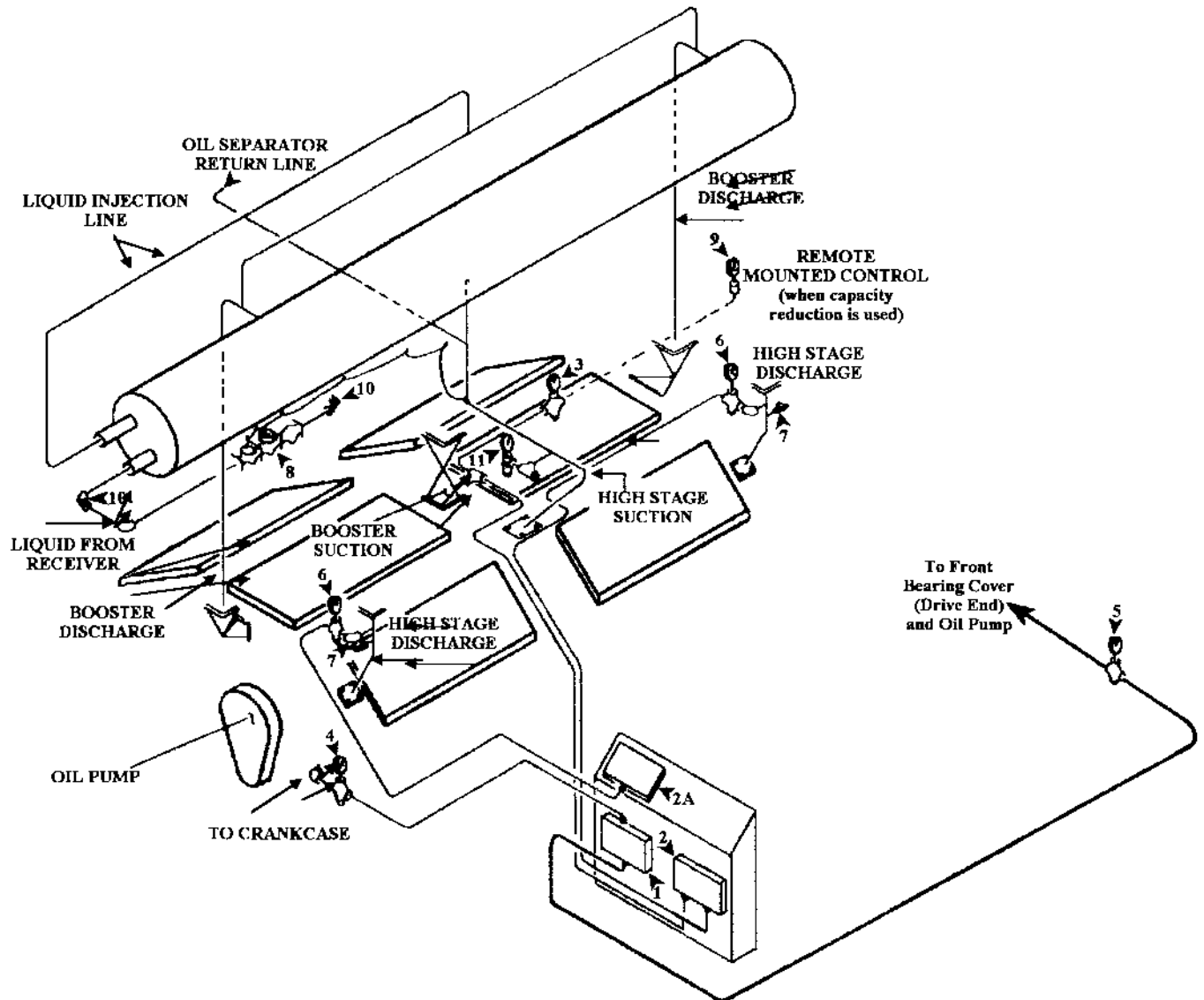
KEY

ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
1	Oil Pressure Failure Switch ("PSO")	7	Safety Valve Set @ 300 psig (2)
2	Dual Pressure Switch ("PSD")	8	Thermostatic Expansion Valve, Solenoid Valve ("SVL") and Strainer Assembly
2A	High Pressure Switch ("PSH")	9	Capacity Control Switch ("PC-1")
3	Low Pressure Gauge	10	Liquid Line Valve (2)
4	Crankcase Pressure Gauge	11	Intermediate Pressure Gauge
5	Oil Pressure Gauge		
6	High Pressure Gauge (2)		

**FIGURE 16. REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM
TWELVE CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH INTERCOOLER**

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VILTER MultiCylinder Compressor



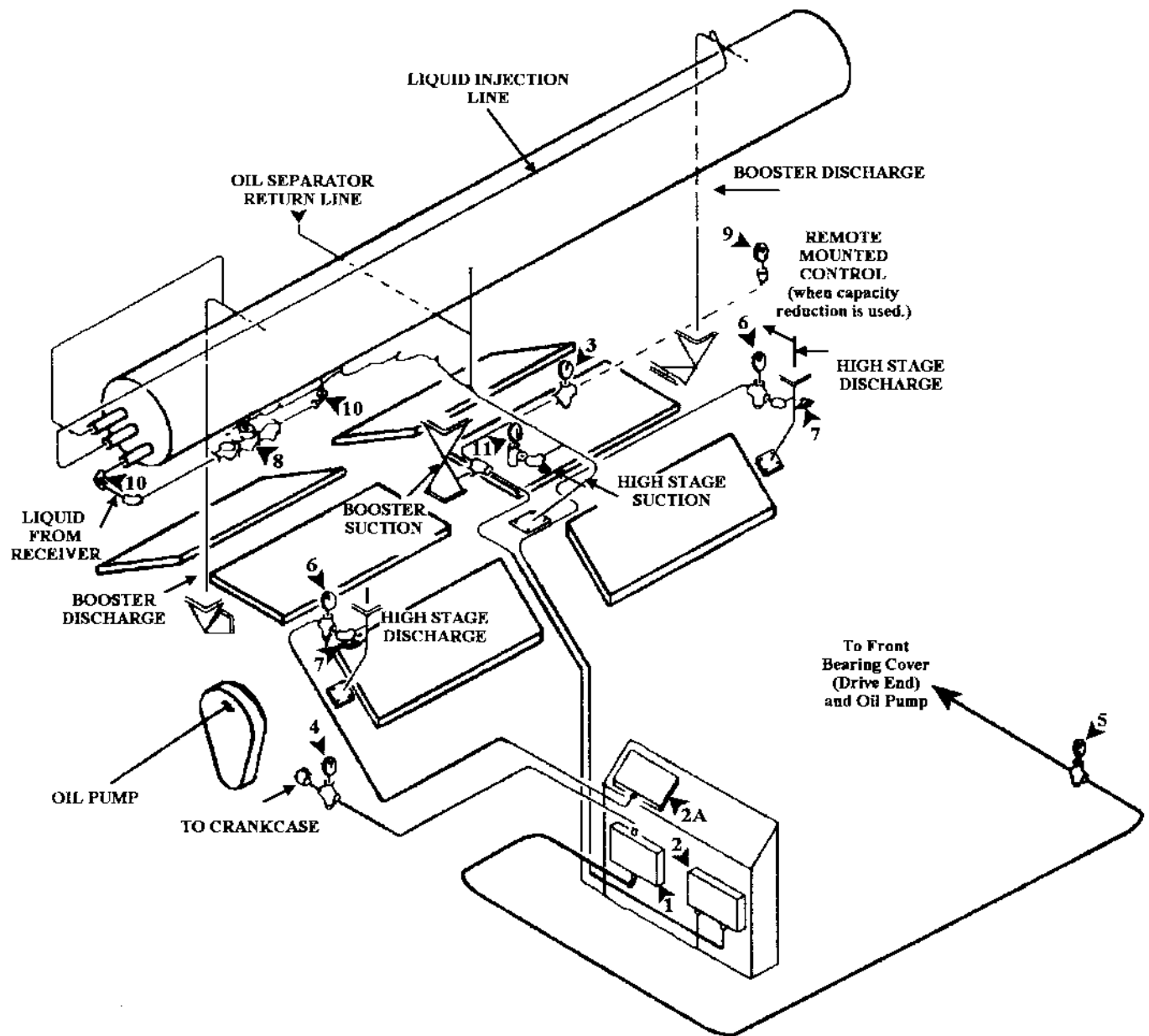
KEY

ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
1	Oil Pressure Failure Switch ("PSO")	7	Safety Valve set @ 300 psig (2)
2	Dual Pressure Switch ("PSD")	8	Thermostatic Expansion Valve, Solenoid Valve ("SVL") and Strainer Assembly
2A	High Pressure Switch ("PSH")	9	Capacity Control Switch ("PC-1")
3	Low Pressure Gauge	10	Liquid Line Valve (2)
4	Crankcase Pressure Gauge	11	Intermediate Pressure Gauge
5	Oil Pressure Gauge		
6	High Pressure Gauge (2)		

**FIGURE 17. REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM
TWELVE CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH AMMONIA DESUPERHEATER**

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor



KEY

ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
1	Oil Pressure Failure Switch ("PSO")	7	Safety Valve set @ 300 psig (2)
2	Dual Pressure Switch ("PSD")	8	Thermostatic Expansion Valve, Solenoid Valve ("SVL") and Strainer Assembly
2A	High Pressure Switch ("PSH")	9	Capacity Control Switch ("PC-1")
3	Low Pressure Gauge	10	Liquid Line Valve (2)
4	Crankcase Pressure Gauge	11	Intermediate Pressure Gauge
5	Oil Pressure Gauge		
6	High Pressure Gauge (2)		

**FIGURE 18. REFRIGERANT AND PRESSURE CONNECTIONS SCHEMATIC DIAGRAM
TWELVE CYLINDER INTEGRAL TWO STAGE COMPRESSOR WITH HALOCARBON DESUPERHEATER**

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

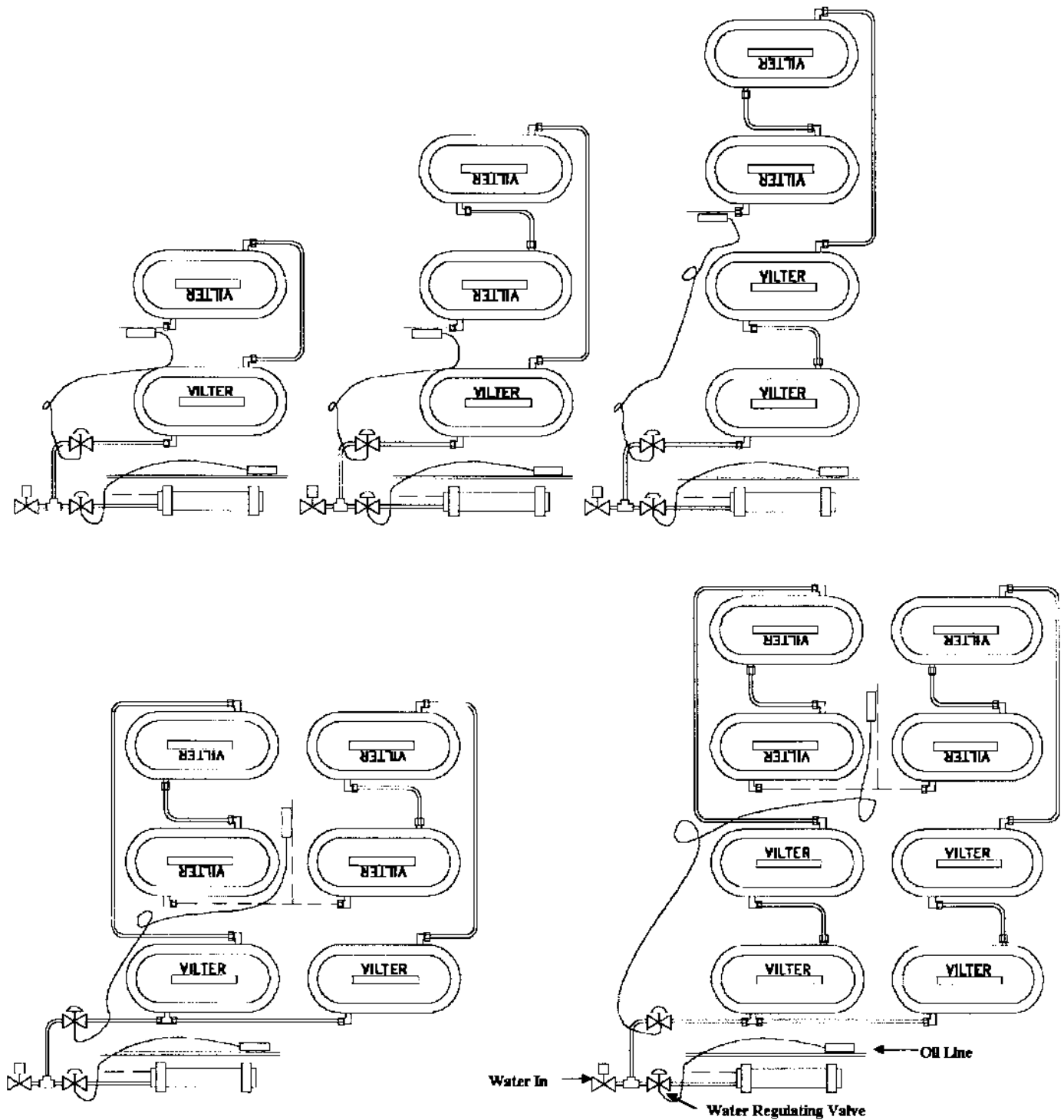
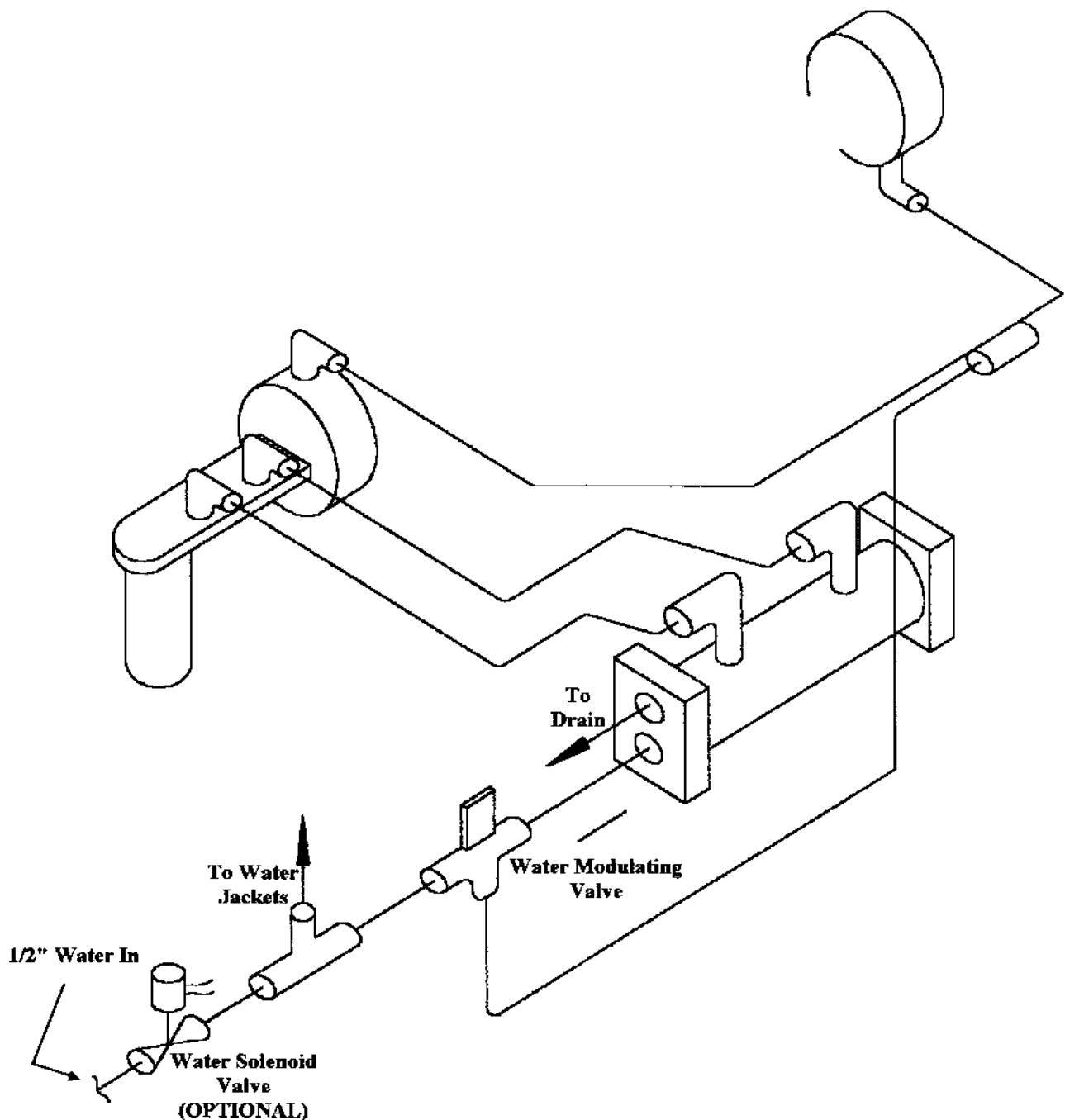


FIGURE 19. 450XL WATER JACKET CONNECTIONS

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NOTES:

- 1) Set Modulating Valve to maintain a 110° to 125°F crankcase oil temperature.
- 2) Maximum crankcase oil temperature is 150°F.
- 3) Maximum water inlet temperature is 80°F.
- 4) Maximum water flow is 4 GPM.

FIGURE 20. 450XL WATER MODULATING VALVE CONNECTIONS

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VILTER MultiCylinder Compressor

TABLE 3. 320, 340, 350ES VMC COMPRESSOR MAXIMUM LIMITS

Suction Superheat:	25°F (-3.9°C)	Discharge Pressure:	350 PSIG (2413.18 kPa)
Compression Ratio:	12:1 (R22)	Suction Pressure:	85 PSIG (586.06 kPa)
Pressure Differential	300 PSIG (2068.44 kPa)	Oil Temperature:	150°F (65.5°C)
Discharge Temperature:	300°F (148.9°C)	Direct Drive Motor Horsepower:	150 BHP (111.85 kW)

V-BELT DRIVE HORSEPOWER LIMITS					
SIZE	RPM (RAD/S)	MAX. BHP * (kW)	SIZE	RPM (RAD/S)	MAX. BHP * (kW)
323 – 328	1750 (183.23 rad/s)	75 (55.93 kW)	355ES	1055 (110.46 rad/s)	40 (28.83 kW)
	1435 (150.24 rad/s)	60 (44.74 kW)		844 (88.37 rad/s)	30 (22.37 kW)
343 – 348	1274 (133.39 rad/s)	50 (37.29 kW)	358ES	720 (75.38 rad/s)	30 (22.37 kW)

NOTES:

Recommended operating oil temperature is 100°F to 130°F (37.8°F to 54.4°F). Operating at or near maximum oil temperature could result in excessive wear.

* Increase 15% when shot peened crankshaft is ordered.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

TABLE 4. 440 VMC COMPRESSOR MAXIMUM LIMITS

Suction Superheat:	25°F (-3.9°C)	Discharge Pressure:	350 PSIG (2413.18 kPa)
Compression Ratio:	12:1 (R22)	Suction Pressure:	150 PSIG (1034.22 kPa)
Pressure Differential	175 PSIG (1206.59 kPa)	Oil Temperature:	150°F (65.5°C)
Discharge Temperature:	300°F (148.9°C)	Direct Drive Motor Horsepower:	300 BHP (223.71 kW)

V-BELT DRIVE HORSEPOWER LIMITS					
SIZE	RPM (RAD/S)	MAX. BHP * (kW)	SIZE	RPM (RAD/S)	MAX. BHP * (kW)
442	1200 (125.64 rad/s)	113 (84.25 kW)	448HD	1200 (125.64 rad/s)	125 (93.21 kW)
	1130 (118.31 rad/s)	109 (81.28 kW)		1130 (118.31 rad/s)	120 (89.48 kW)
	1000 (104.7 rad/s)	100 (74.57 kW)		1000 (104.7 rad/s)	110 (82.03 kW)
444	900 (94.23 rad/s)	95 (70.84 kW)	4512	900 (94.23 rad/s)	104 (77.55 kW)
446	810 (84.81 rad/s)	80 (59.66 kW)		810 (84.81 rad/s)	88 (65.62 kW)
	730 (76.43 rad/s)	70 (52.2 kW)		730 (76.43 rad/s)	77 (57.42 kW)
448			4516		

NOTES:

Recommended operating oil temperature 100°F to 130°F (37.8°C to 54.4°C). Operating at or near maximum oil temperature could result in excessive wear.

* Increase 15% when shot peened crankshaft is ordered.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

TABLE 5. 450 VMC COMPRESSOR MAXIMUM LIMITS

Suction Superheat:	(R717) 25°F (-3.9°C)	Discharge Pressure:	350 PSIG (2413.18 kPa)
Compression Ratio:	8:1 (R717)	Suction Pressure:	150 PSIG (1034.22 kPa)
Pressure Differential	175 PSIG (1206.59 kPa)	Oil Temperature:	150°F (65.5°C)
Discharge Temperature:	300°F (148.9°C)	Direct Drive Motor Horsepower:	
		VMC 450	300 BHP (223.71 kW)
		VMC 458/4516	375 BHP (279.64 kW)

V-BELT DRIVE HORSEPOWER LIMITS					
SIZE	RPM (RAD/S)	MAX. BHP * (kW)	SIZE	RPM (RAD/S)	MAX. BHP * (kW)
452	1200 (125.64 rad/s)	113 (84.25 kW)	448HD	1200 (125.64 rad/s)	195 (145.41 kW)
	1130 (118.31 rad/s)	109 (81.28 kW)		1130 (118.31 rad/s)	185 (137.95 kW)
	1000 (104.7 rad/s)	100 (74.57 kW)		1000 (104.7 rad/s)	165 (123.04 kW)
	900 (94.23 rad/s)	95 (70.84 kW)		900 (94.23 rad/s)	145 (108.13 kW)
454	810 (84.81 rad/s)	80 (59.66 kW)	458HD *	810 (84.81 rad/s)	130 (96.94 kW)
	730 (76.43 rad/s)	70 (52.2 kW)		730 (76.43 rad/s)	120 (89.48 kW)
	1200 (125.64 rad/s)	144 (107.38 kW)		1200 (125.64 rad/s)	300 (223.71 kW)
	1130 (118.31 rad/s)	138 (102.91 kW)		1130 (118.31 rad/s)	285 (212.13 kW)
456	1000 (104.7 rad/s)	120 (89.48 kW)	4516HD *	1000 (104.7 rad/s)	250 (186.43 kW)
	900 (94.23 rad/s)	100 (74.57 kW)		900 (94.23 rad/s)	225 (167.78 kW)
	810 (84.81 rad/s)	90 (67.11 kW)		810 (84.81 rad/s)	200 (149.14 kW)
	730 (76.43 rad/s)			730 (76.43 rad/s)	185 (137.95 kW)

NOTE:

Recommended operating oil temperature is 100°F to 130°F (37.8°C to 54.4°C). Operating at or near maximum oil temperature could result in excessive wear.

* HD: Large Diameter (3-1/8" (7.94 cm) crankpin.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

TABLE 6. 450XL VMC COMPRESSOR MAXIMUM LIMITS

Suction Superheat:	(R717) 25°F (-3.9°C)	Discharge Pressure:	350 PSIG (2413.18 kPa)
Compression Ratio:	8:1 (R717) 10:1 (R290) 12:1 (R22)	Suction Pressure:	150 PSIG (1034.22 kPa)
Pressure Differential:	250 PSIG (1723.7 kPa)	Oil Temperature:	150°F (65.6°C)
Discharge Temperature:	300°F (148.9°C)	Direct Drive Motor Horsepower:	375 BHP (279.64 kW)

V-BELT DRIVE HORSEPOWER LIMITS

SIZE	RPM (RAD/S)	MAX. BHP (kW)	SIZE	RPM (RAD/S)	MAX. BHP * (kW)
452XL	1200 (125.43 rad/s)	195 (145.41 kW)	4512XL	1200 (125.64 rad/s)	300 (223.71 kW)
454XL	1130 (118.31 rad/s)	185 (137.95 kW)		1130 (118.31 rad/s)	285 (212.52 kW)
456XL	1000 (104.7 rad/s)	165 (123.04 kW)		1000 (104.7 rad/s)	250 (186.43 kW)
458XL	900 (94.23 rad/s)	145 (108.13 kW)	4516XL	900 (94.23 rad/s)	225 (167.78 kW)
	810 (84.81 rad/s)	130 (96.94 kW)		810 (84.81 rad/s)	200 (149.14 kW)
	730 (76.43 rad/s)	120 (89.48 kW)		730 (76.43 rad/s)	180 (134.23 kW)

NOTE:

Recommended operating oil temperature is 100°F to 130°F (37.8°C to 54.4°C). Operating at or near maximum oil temperature could result in excessive wear.

P28 and P128 Series Lube Oil Controls with Built-in Time Delay Relay

The P28 and P128 Series Lube Oil Controls provide dependable and economical oil pressure cut-out for pressure-lubricated refrigeration compressors. The field-adjustable pressure differential of these controls provides compressor operation according to the manufacturer's specifications. The P28 and P128 controls operate by measuring the net lube oil pressure and de-energizing the compressor if the pressure falls below the differential setpoint.

Manual or automatic reset models are available with factory set and sealed time delays of 30, 45, 60, 90, or 120 seconds (all time delays may not be available on all models). The P128 is the same control as the P28 but with 1/4 inch male flare pressure connections.



Figure 1: P128AA

Features and Benefits	
Built-in Time Delay Relay with Ambient Compensation	Minimizes timing fluctuations due to temperature variations
Trip-free Manual Reset	Provides manual reset that cannot be overridden by pressing and holding the reset button
Replaceable Time Delay Relay Assembly	Allows easy field replacement of the time delay relay and terminal board
Available with Runlight and Alarm Terminals	Allows the control to be wired for normal oil pressure runlight signals and shutdown alarm circuits for remote monitoring of oil pressure status

Introduction



WARNING: Personal injury hazard. All P28 and P128 controls are designed as lubrication protection controls. Failure of the P28 or P128 could allow the refrigeration compressor to be damaged in a way that may not be apparent upon visual inspection. Follow proper procedures and the compressor manufacturer's instructions, as well as any warning signs on or around the equipment, when discharging and disassembling the compressor.

Environmental damage hazard. If leakage of sensed media (such as refrigerant or oil) can be harmful to the environment, or hazardous in any way, user must provide for proper containment.

The P28 and P128 controls measure the net oil pressure available to circulate oil throughout a pressure-lubricated refrigeration system. The net oil pressure is the difference between the oil pressure at the pump discharge and the refrigerant pressure in the compressor crankcase.

Example: If the oil pressure pump discharge reading is 90 psi (621 kPa) and the crankcase pressure is 70 psi (483 kPa), the net oil pressure is 20 psi (138 kPa).

The P28 and P128 have a built-in time delay relay. This relay allows the oil pressure to build up for the time delay period before the compressor trips. This also prevents nuisance lockouts due to intermittent loss of oil pressure. The time delay relay is a "trip free" device. The manual reset cannot be overridden by pressing and holding the reset button.

Manual reset models are available with time delays of 30, 45, 60, 90, or 120 seconds. Automatic reset models are available with a 90-second time delay. The time delay relay is compensated to minimize the effect of ambient temperature variations. However, the time delay relay will be affected by voltage variations.

Dimensions

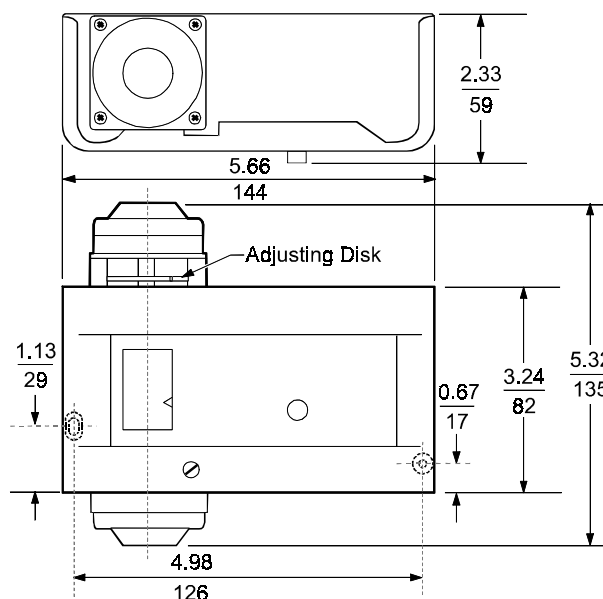


Figure 2: P28 or P128 Dimensions (in./mm)

Operation

When the compressor starts, the timer is energized because the net oil pressure of the system is zero. During normal operation, the net oil pressure should build up to the pressure switch's cut-out setting (scale setting) plus the switch differential (3 to 5 psi [21 to 34 kPa]) within the required time delay, causing the time delay relay to de-energize.

If the net oil pressure does not rise to the cut-out pressure setting plus the switch differential within the required time delay, the time delay relay trips and stops the compressor.

If the net oil pressure drops below the cut-out pressure setting during the compressor's run cycle, the time delay relay energizes. If the net oil pressure returns within the time delay, the time delay relay de-energizes and the compressor continues to operate normally. If the net oil pressure does not return within the time delay, the control shuts down and locks out the compressor.

Example: Net oil pressure (oil pump pressure minus crankcase pressure) required to the bearings is 9 psi (62 kPa). The control scale setting should be 9 psi (62 kPa). The switch differential is 5 psi (34 kPa). Upon initial start of the compressor, the time delay relay energizes. If the net oil pressure does not build up to 14 psi (97 kPa), or the scale setting (9 psi) plus the switch differential (5 psi), during the time delay, the control breaks the circuit to the compressor. If the pressure of 14 psi (97 kPa) is reached during the time delay, the time delay relay de-energizes and the compressor continues to operate normally.

/Installation

Mounting



CAUTION: Equipment damage hazard.

- A P28AN or P28DN control used for ammonia service must be mounted separately from the electrical cabinet. An ammonia leak could damage the electrical circuitry.
- Do not use Johnson Controls/Penn Ecosafe® hose tubing in applications with ammonia or other corrosive refrigerants. Corrosion could cause tube breakage and refrigerant leakage.
- Use **only** the mounting screws supplied with the control. Damage to internal components may occur if other screws are used.

The P28 and P128 controls are not position sensitive and can be mounted in any position.

Use the two mounting screw holes located on the back of the control case to mount the control directly to a wall or panel board. Mount the control so that the pressure connections on the bellows are above the crankcase liquid level of the equipment being controlled.

Note: When mounting the control to a compressor is required, a mounting bracket (Part No. 271-51) is available.

Pressure Connections



CAUTION: Equipment damage hazard.

- Avoid sharp bends or kinks in the capillary or tubing to avoid damage to the capillary.
- Coil and secure excess capillary or tubing. Because harmonic vibration can break the capillary or tubing, some slack must be provided.
- Do not allow the capillary or tubing to rub against metal surfaces where friction can cause damage.
- When using a control with 1/4 in. / 6.4 mm tubing, a pulsation damper must be used. Pulsation can cause excessive wear and damage the control.

1. Purge all tubing and lines before connecting the pressure control.
2. Connect the oil pressure line pump discharge to the pressure connector labeled "OIL."
3. Connect the crankcase pressure line to the pressure connector labeled "LOW."
4. Coil and secure excess capillary or tubing to avoid vibration.

Wiring



WARNING: Shock hazard. Disconnect all power supplies before making wiring connections to avoid electrical shock or damage to the equipment.

- Make all wiring connections using copper conductors only.
- Wire in accordance with National Electric Code and local regulations. For maximum electrical rating of the control, see the label inside the control cover.
- Use the terminal screws furnished (8-32 x 1/4 in. binder head). Substitution of other screws may cause faulty connections.

See Figures 3 through 10 for typical wiring diagrams or refer to the compressor manufacturer’s specifications.

When the P28 or P128 control is supplied with a Terminal 3, it may be wired to operate a runlight for indicating when there is sufficient net oil pressure. When the control is supplied with a Terminal A, it can be wired to operate a shutdown alarm or signal for indicating when the compressor has tripped.

For applications using a 208V control circuit, it is suggested that one leg of the 208V circuit and a neutral or ground wire be used as a 120V source to power the time delay relay.

When a P28 or P128 is installed on a 440 or 550 VAC system, use an external step-down transformer to provide either 120 or 240V to the pilot and time delay relay circuits. The transformer must be of sufficient volt ampere capacity to operate the motor starter and the time delay relay. Table 1 presents the power requirements for the P28 or P128 time delay relay. Table 2 presents the electrical ratings.

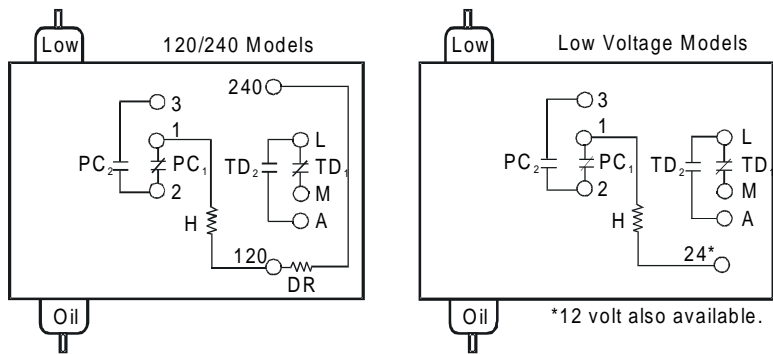
Table 1: Electrical Power Required for Time Delay Relay

Timing in Seconds	Voltage	
	12, 24, or 120V	240V
30, 45, 60, 90, or 120	15 VA	30 VA

Table 2: Electrical Ratings--Pilot Duty

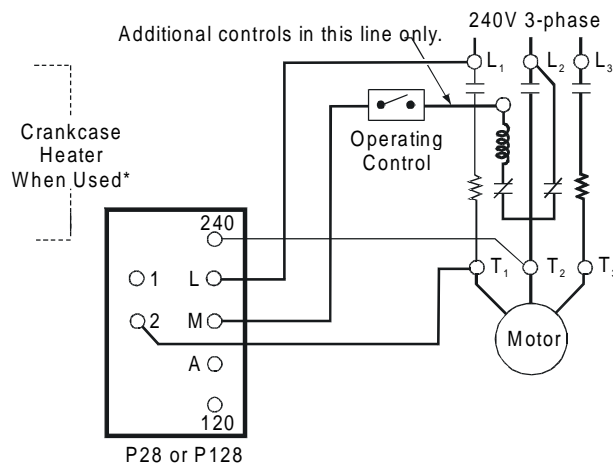
Time Delay Relay Circuit	Pilot Circuit	Alarm Circuit*	Crankcase Heater** (Terminal 1)	Runlight** (Terminal 3)
120/240 VAC	750 VA, 120/240 VAC	10W Tungsten, 120/240 VAC	10 Ampere, 120 VAC 5 Ampere, 240 VAC	10W Tungsten
24 VAC/VDC 12 VAC/VDC	125 VA, 24 VAC 57.5 VA, 24 VDC	125 VA, 24 VAC 57.5 VA, 24 VDC	--	10W Tungsten

* Must be the same voltage as the pilot circuit.
** Must be the same voltage as the time delay relay circuit.



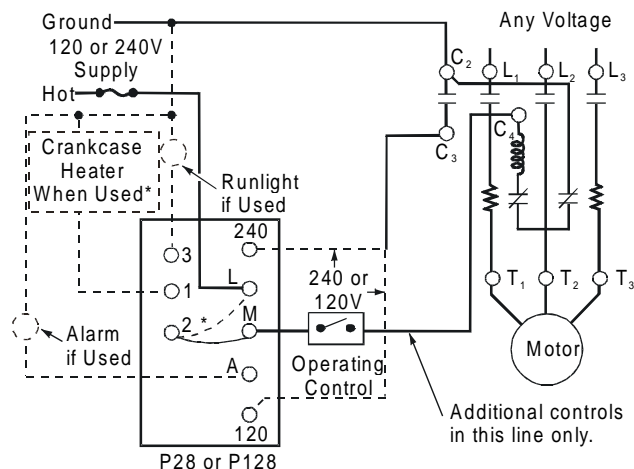
PC₁ - Pressure actuated contacts. Open on increase in pressure difference between oil and low pressure connectors. Makes and breaks time delay heater circuit.
PC₂ - Contacts close simultaneously when PC₁ contacts open (runlight circuit).
TD₁ - Time delay relay. Contacts open after time delay interval if pressure difference between oil and low pressure connectors is not established or maintained.
TD₂ - Contacts close simultaneously when TD₁ contacts open (alarm circuit).
DR - Voltage dropping resistor used in dual voltage models.
H - Heater for time delay relay.
Connect Terminals L and M as a single pole switch.
Connect Terminals 2 and 240 or 120 to energize circuit only when motor starter is closed.

Figure 3: P28 or P128 Internal Wiring Circuit, Showing Alarm Circuit and Runlight Terminals



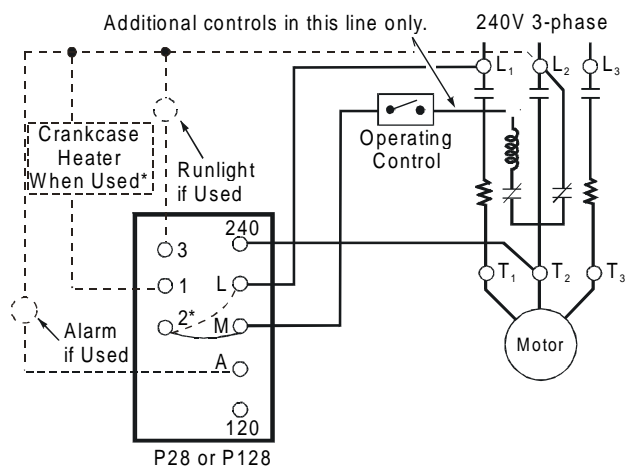
*Crankcase heater cannot be cycled with this hookup. See Figure 5.

Figure 4: P28 or P128 Used on a 240V System with 240V Magnetic Starter Coil



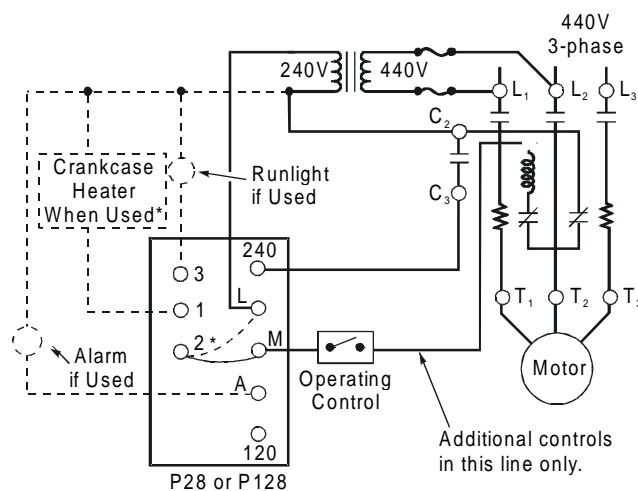
*When crankcase heater is used, disconnect jumper from 2 to M and reconnect from 2 to L.

Figure 6: P28 or P128 Where Separate Supply is Provided for Control Circuit (Jumper between 2 and M [or L] must be field installed.)



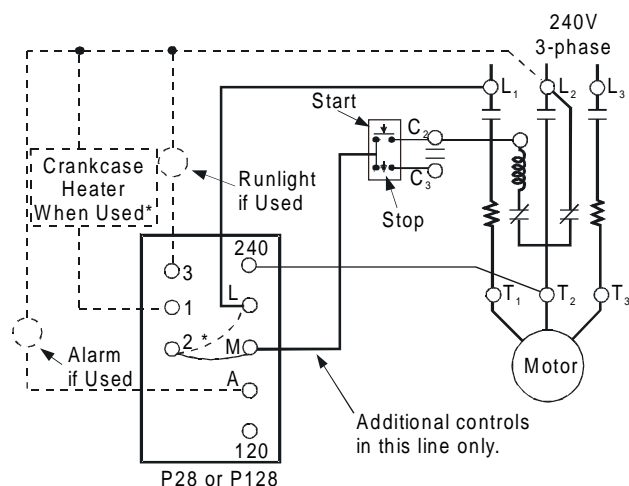
*When crankcase heater is used, disconnect jumper from 2 to M and reconnect from 2 to L.

Figure 5: P28 or P128 Wired for 3-wire Control (Jumper between 2 and M [or L] must be field installed.)



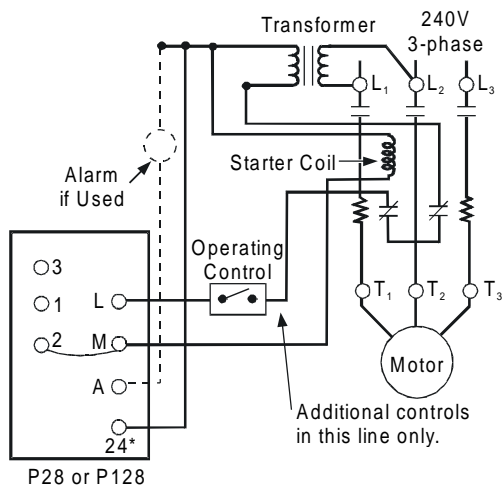
*When crankcase heater is used, disconnect jumper 2 to M and reconnect 2 to L. Also, make sure that control circuit transformer has sufficient output for additional load.

Figure 7: P28 or P128 Wired for 440V Supply and 240V Magnetic Start Coil (Also for 550V Using Proper Transformer) (Jumper between 2 and M [or L] must be field installed.)



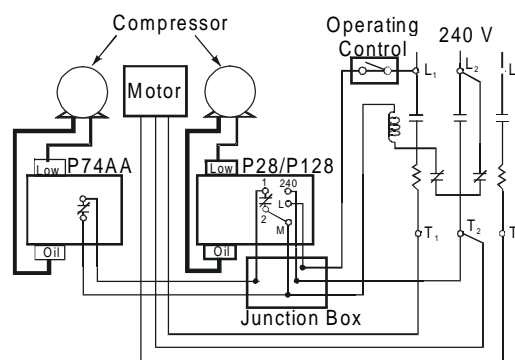
*When cranks case heater is used, disconnect jumper from 2 to M and reconnect 2 to L.

Figure 8: P28 or P128 Where Manual "Start-Stop" Pushbutton Station is Used (Jumper between 2 and M [or L] must be field installed.)



*12 volt also available.

Figure 9: P28 or P128 Where 24V Control Circuit Power is from a Step-down Transformer (Jumper between 2 and M must be field installed.)



Note: This system would provide shutdown on low lube oil pressure in either of two compressors operated by the common motor.

Figure 10: P28 or P128 and P74AA Wired for an Oil Pressure Control System Where One Motor Operates Two Compressors

Adjustments

The P28 and P128 controls are shipped with a cut-out pressure differential of 9 psi (62 kPa). However, the controls can be adjusted according to the compressor manufacturer's specifications.

Note: When the controls are shipped as an accessory to the compressor unit, time delay and cut-out pressure are set to manufacturer's specifications. Replacement controls should duplicate the manufacturer's specifications.



CAUTION: Equipment damage hazard.

To avoid damage to the compressor, obtain the compressor manufacturer's net oil bearing pressure specifications as soon as possible. If necessary, reset the cut-out pressure difference to the manufacturer's specifications.

When the manufacturer's specifications are not known, proceed as follows to set the cut-out pressure differential:

1. With the compressor running, read the oil pressure and the cranks case pressure.
2. Subtract the cranks case pressure reading from the oil pressure pump discharge reading. This is the net oil pressure to the bearings.

3. Set the cut-out pointer 6 to 8 psi (41 to 55 kPa) below the established running net oil pressure with the Adjusting Disk using a standard screwdriver.

To increase the cut-out pressure, turn the Adjusting Disk counterclockwise. To decrease, turn clockwise.

To raise the pressure differential, turn the Adjusting Disk (see Figure 2) to the left when viewing the front of the control. Turn the adjusting disk to the right to lower the pressure differential.

Test for Shutdown

Immediately after installing, and at regular intervals thereafter, the time delay relay should be tested to verify that all circuits are operating correctly.



WARNING: Shock hazard. Disconnect power from the control before testing for shutdown to avoid electrical shock or damage to the equipment.

To test for shutdown:

1. Remove power from the control and remove the control cover.
2. Connect a jumper between Terminals 1 and 2. See Figure 3 for terminal locations.

Note: If the control is mounted on a condensing unit where air from auxiliary equipment (blowers or fans) may strike the control, the control cover should be replaced before proceeding to Step 3.

3. Apply power to start the compressor. The time delay relay should trip after the time interval and stop the compressor.

4. Remove power from the control and remove the jumper between Terminals 1 and 2.

5. Replace the cover on the control and apply power.

6. Manually reset the time delay relay if required.

Checkout Procedure

Before leaving the installation, observe at least three complete operating cycles to be sure that all components are functioning correctly.

Fungus Proofing

Fungus proofing can be supplied at extra cost when specified. Conforms to government specifications MIL-V-173A.

Repairs and Replacement

Field repairs must not be made, except for replacement of the time delay relay assembly. For a replacement control or time delay relay assembly, contact the nearest Johnson Controls representative or Refrigeration Application Engineering at 414-274-5535.

Table 3: Replacement Time Delay Relay Assemblies

Part Number	Voltage	Reset Type	Timing in Seconds	Alarm Circuit
RLY13A-600R	120/240 VAC	Manual	60	No
RLY13A-602R	120/240 VAC	Manual	90	No
RLY13A-603R	120/240 VAC	Manual	90	Yes
RLY13A-608R	120/240 VAC	Automatic	90	No
RLY13A-609R	24 VAC/VDC	Manual	120	No
RLY13A-610R	120/240 VAC	Manual	30	No
RLY13A-616R	120/240 VAC	Manual	120	No
RLY13A-617R	120/240 VAC	Manual	45	No

Ordering Information

Table 4: Ordering Information

Series Part Number	Pressure Connections*	Reset Type	Refrigerant	Time Delay Relay Voltage	Alarm Terminal	Runlight Terminal
P28AA	Style 13, Style 5, or Style 15	Manual	Non-corrosive All-range	120/240 VAC	No	No
P128AA	Style 5	Manual	Non-corrosive All-range	120/240 VAC	No	No
P28AN	Style 15	Manual	Ammonia	120/240 VAC	No	No
P28DA	Style 13	Manual	Non-corrosive All-range	120/240 VAC	Yes	Yes
P28DN	Style 15	Manual	Ammonia	120/240 VAC	Yes	Yes
P28GA	Style 13	Automatic	Non-corrosive All-range	120/240 VAC	No	No
P28NA	Style 13 or Style 5	Manual	Non-corrosive All-range	24 VAC/VDC	No	No
P28PA	Style 5	Manual	Non-corrosive All-range	24 VAC/VDC	No	No

* Style 5 connections are 1/4 in. / 6.4 mm SAE male flare connectors (no capillary tubing). Style 13 connections are 3/8 in. / 9.5 mm capillary tubing and 1/4 in. / 6.4 mm flare nut. Style 15 connections are 1/4 in. / 6.4 mm female National Pipe Thread connectors.

Specifications

Product	P28 and P128 Series Lube Oil Controls with Built-in Time Delay Relay
Power Requirements	See Tables 1 and 2.
Pressure Specifications	Adjustable Cut-out Pressure Difference: 8 to 70 psi (55 to 483 kPa)* Maximum Differential: 70 psi (483 kPa) Maximum Working Pressure: 250 psig (1724 kPa) on the high side Maximum Overpressure: 325 psi (2240 kPa) oil and low side pressure <i>*The time delay relay is de-energized 3 to 5 psi (21 to 34 kPa) above the cut-out scale setting.</i>
Pressure Switch Units	Enclosed Dust-protected Pennswitch
Ambient Operating Conditions	32 to 104°F / 0 to 40°C
Material	Case: 0.062 in. / 1.6 mm Galvanized Steel Cover: 0.028 in. / 0.7 mm Cold Rolled Steel (plated and painted)
Mounting	Flat Surface or with a Universal Mounting Bracket (Part No. 271-51)
Wiring Terminal	Large 8-32 x 1/4 in. Binder Head Screws
Agency Listings	UL Guide No. SDFY; File SA516** CSA Class No. 1222 01; File LR948** <i>**Most models. Contact Johnson Controls for a complete listing.</i>
Dimensions (H x W x D)	5.66 x 5.32 x 2.09 in. / 144 x 135 x 53 mm
Shipping Weight	3.0 lb / 1.36 kg

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls Refrigeration Application Engineering at (414) 274-5535. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



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A70, A72 Series Temperature Controls for Refrigeration and Heating

Application

The A70 single-pole and A72 two-pole controls are supplied in a wide selection of ranges to meet most application needs. See "Temperature Ranges."

Models may be supplied to open a circuit on temperature increase or close a circuit on temperature increase as required. An A70 single-pole control may optionally include a separate reverse-acting auxiliary contact. Models are available with a SPDT enclosed Pennswitch.

All Series A70, A72 controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Specifications

Series	A70	Single Pole, See Table for Type Number Selection
	A72	Two Pole, See Table for Type Number Selection
Adjusting		Screwdriver Slot, Adjusting Knob On Differential or Range Screw, When Required
Capillary		6' (1.8 m) Long Standard. Longer Capillary Tube Up to 10' (3 m) in 2' (0.6 m) Increments. Over 10' in 5' (1.5 m) Increments
Contact Action		Open On Rise, Close On Rise, SPDT, As Required
Contact Unit		Snap-Acting High Contact Force Right Up to Contact Break Point, No Bounce, Beryllium Copper Conductor Leaves with Silver-Cadmium Oxide Contacts
Finish		Gray Baked Enamel
Material	Case	0.062" (1.6 mm) Cold Rolled Steel
	Cover	0.028" (0.7 mm) Cold Rolled Steel
Mounting		Holes in Back of Case or with Part No. 271-350 Mounting Bracket. Controls Supplied Less Bracket Unless Specified
Shipping Weights Approx.*	Less Knob	2.4 lb (1.1 kg)
	With Knob	2.5 lb (1.1 kg)
	Overpack of 20	49 lb (22.2 kg)

*Weights will vary somewhat depending on construction features supplied, type of element, etc.

Features

- Long life contact structure with high contact force right up to break -- no bounce on make.
- Make reset models are "trip-free".
- Ranges available to cover most applications.
- Auxiliary contact can be used to actuate an alarm circuit when the main contact opens.
- Two-pole construction provides a number of application advantages (see "General Description").
- Heavy gauge "low profile" stainless steel element cup to protect against mechanical damage.



Fig. 1 -- Single function temperature control, Style 1.

General Description

The A70 controls provide dependability and quality at attractive prices. The A72 DPST controls provide a number of application advantages such as:

- Control of polyphase motors without use of magnetic starters where protection against overloading and single phasing is otherwise provided.
- Provides two separate control circuits necessary for the control of multiple systems.
- One set of contacts breaks the "hot" line when wired as a two-pole switch in single-phase circuits.
- Permits control of two separate load circuits.
- Automatic control of heavy electrical loads.
- All A70, A72 controls have a single calibrated scale which shows directly both cut-in and cutout settings. Adjustments can be made readily without removing the cover.

Optional Constructions

Adjusting Knobs

May be supplied on differential or range adjusting screw for limited adjustment within specified limits.

Adjustment Cutout Stops

Cutout stops, factory set as specified.

Bulb and Capillary

Standard bulb and capillary are copper. Stainless steel, monel and steel bulbs are available, if required. Bulb and capillary with neoprene coating to military specifications MIL-R-3065, Grade SB-515-ABFF may be supplied at additional cost. Capillary length 6 ft (1.8 m) only.

Bulb Wells

Supplied at extra cost, when specified.

Capillary Tubing

Standard temperature elements supplied with 6 ft (1.8 m) capillary. Extra length tube available at additional cost. Longer capillary tube supplied up to 10 feet (3 m) in 2 foot (0.6 m) increments; over 10 feet (3 m) in 5 foot (1.5 m) increments.

Contact Action

Open on rise or close on rise as specified.

Covers

Standard finish is gray enamel. Stainless steel covers available at slight additional cost for exposed installations.

Fungus Proofing

Supplied at extra cost, when specified. Conforms to government specifications MIL-V-173A.

Manual Reset

Provides lockout which requires manual reset before a restart is possible. Manual reset is "trip-free" and cannot be blocked or tied down. Button must be pressed and released before operation will resume.

Metric Scale Plates

Temperature models are available with Celsius plates.

Mounting Brackets

Controls are supplied less bracket unless specified. Controls may be supplied with mounting brackets at additional cost. Part No. 271-350 is standard.

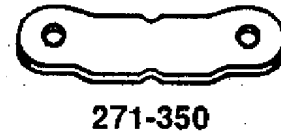


Fig. 2 -- Standard mounting bracket

Temperature Elements

Standard temperature element styles are shown on Page 5. For styles other than shown, please check with the nearest Johnson Controls district office or Customer Service.

Type Number Selection

Type Number	Main Contact Action	No. of Poles	Lockout with Manual Reset	Knob	Conduit Opening	Misc.
Single-Pole						
A70AA	Open Low	1	No	No	1/2 in.	
A70AQ	Open Low	1	No	Yes	1/2 in.	Manual Start
A70BA	Open Low	1	Yes	No	1/2 in.	
A70DA	Open High	1	Yes	No	1/2 in.	
A70GA	Open Low	1	No	No	1/2 in.	Reverse Acting Aux. Contact
A70HA	Open Low	1	Yes	No	1/2 in.	Reverse Acting Aux. Contact
A70JA	Open High	1	No	No	1/2 in.	Reverse Acting Aux. Contact
A70KA	Open High	1	Yes	No	1/2 in.	Reverse Acting Aux. Contact
Two-Pole						
A72AA	Open Low	2	No	No	3/4 in.	
A72AC	Open Low	2	No	No	3/4 in.	No Cover
A72AE	Open Low	2	No	No	3/4 in.	Outdoor Case
A72AP	Open Low	2	No	No	3/4 in.	Manual Start
A72CA	Open High	2	No	No	3/4 in.	
A72CE	Open High	2	No	No	3/4 in.	Outdoor Case

P74 Series Differential Pressure Controls

Application

These differential pressure controls are for use as operating controls and/or indicating system functions through display lights or panels. They measure the difference in pressure exerted upon its two sensing elements.

The controls are available for applications sensing air, oil or liquid. Typical applications are proof of flow across a chiller or water cooled condenser, proof of flow in a heating or cooling coil and lube oil pressure sensing on refrigeration compressors. On a proof of flow application the control measures pressure drop across two different points in either a closed water circulating system or a city water to supply system.

Specifications

Type Number	P74AA	SPST, Contacts Open on Differential Pressure Increase
	P74AB	SPST, Contacts Open on Differential Pressure Increase, Manual Reset
	P74BA	SPST, Contacts Close on Differential Pressure Increase
	P74CA	DPST, Contacts Open on Differential Pressure Increase
	P74CB	DPST, Contacts Open on Differential Pressure Increase, Manual Reset
	P74DA	DPST, Contacts Close on Differential Pressure Increase
	P74DB	DPST, Contacts Close on Differential Pressure Increase, Manual Reset
	P74EA	SPDT, Standard Switch Differential
	P74FA	SPDT, Narrow Switch Differential
	P74GA	Main Contacts Open on Differential Increase, Separate Auxiliary Contacts Close
	P74HA	Main Contacts Close on Differential Increase, Separate Auxiliary Contacts Open
Ambient Temperature	Minimum	32°F (0°C)
	Maximum	104°F (40°C)
Conduit Opening	3/8" (22 mm) Diameter Hole for 1/2" Conduit	
Contact Unit	P74A, P74B, P74C, P74D, P74G, P74H	Large Copper Backed Silver Contacts and Beryllium Copper Conductor Leaves
	P74E, P74F	SPDT, Snap-Acting Contacts in Dust Protected Enclosure
Differential	See Table	
Finish	Gray Baked	
Material	Case	.062" (1.6 mm) Cold Rolled Steel
	Cover	.028" (0.7 mm) Cold Rolled Steel
Maximum Pressure	See Table	
Mounting Bracket	Universal Mounting Bracket Part No. 271-51 Supplied as Standard	
Range	See Table	
Shipping Weight	Individual Pack	2.4 lb (1.1 kg)
	Overpack of 20	50.5 lb (22.9 kg)
	Bulk Pack of 25	57 lb (25.9 kg)



Fig. 1: P74 Differential Pressure Control with Style 13 elements.

On a proof of flow application in a water chiller system the control activates a light or signal to indicate a loss of water.

The control may also be applied as a lube oil pressure sensing control on refrigeration compressors. They may be used in combination with P28 and/or P45 oil pressure cutout controls on two compressor, single motor units to reduce the oil system cost. (See Fig. 4.) Special low pressure models are available for variable speed and screw compressor oil pressure applications.

All Series P74 differential pressure controls are designed for use *only* as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Range and Differential Specifications

Differential Pressure Range PSI kPa	Switch Differential PSI kPa			Maximum Differential Pressure Between the Bellows PSI kPa	Maximum Low Pressure Bellows Overrun* PSIG kPa	Bellows Material
	P74A, P74B, P74C, P74D, P74G, P74H	P74E	P74F			
2 to 26 14 to 180	—	3.5 Fixed 24	1.2 Fixed 8	120 830	180 1241	Brass
8 to 60 50 to 400	6 to 20 Adj. 41 to 138	3.8 Fixed 26	1.5 Fixed 10	120 830	180 1241	
2 to 30 14 to 207	—	5.0 Fixed 34	2.0 Fixed 14	200 1379	180 1241	Stainless Steel
8 to 70 50 to 450	8 to 30 Adj. 55 to 207	5.5 Fixed 38	2.5 Fixed 17	200 1379	180 1241	

*Bellows overrun pressure is the pressure supplied to the low pressure side of the control.

Features

- Heavy duty, low profile elements withstand unduly high overrun pressures that may be encountered in shipment or in some machine rooms.
- Lockout models have a “trip-free” manual reset.
- Long life contact structure with high contact force -- no contact bounce.
- Single unit mounting and wiring -- saves installation time and material.

General Description

Single and double pole models are available with contacts that open on a pressure differential increase or close on a pressure differential increase. Also available are models with single-pole, double-throw enclosed contacts or with main and separate reverse-acting auxiliary contacts. Controls with lockout feature require manual reset to reclose circuit after lockout. The “trip-free” reset will not permit restart until reset button is pushed and released.

The operation point of the control is readily adjusted by rotating the adjusting disk. The control set points are easily read on a calibrated scale.

Electrical Ratings

P74AA, P74AB, P74BA

Motor Ratings	1 Phase			
	120 V	208 V	240 V	277 V
AC Full Load Amp	20.0	18.7	17.0	—
AC Locked Rotor Amp	120.0	112.2	102.0	—
AC Non-Inductive Amp	22.0	22.0	22.0	—
Pilot Duty — 125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC				

P74CA, P74CB, P74DA, P74DB

Motor Ratings	1 Phase				Polyphase	
	120 V	208 V	240 V	277 V	208 V	240 V
Horsepower	2	3	3	—	5	5
AC Full Load Amp	24.0	18.7	17.0	—	16.5	15.0
AC Locked Rotor Amp	144.0	112.2	102.0	—	99.0	90.0
AC Non-Inductive Amp	24.0	24.0	24.0	22.0	—	—
Pilot Duty — 125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC						

P74EA

Motor Ratings	120 V	208 V	240 V	277 V
AC Full Load Amp	16.0	9.2	8.0	—
AC Locked Rotor Amp	96.0	55.2	48.0	—
AC Non-Inductive Amp	16.0	16.0	16.0	16.0
Pilot Duty — 125 VA, 120 to 600 VAC				

P74FA

Motor Ratings	120 V	208 V	240 V	277 V
AC Full Load Amp	6.0	3.4	3.0	—
AC Locked Rotor Amp	36.0	20.4	18.0	—
AC Non-Inductive Amp	10.0	10.0	10.0	10.0
Pilot Duty — 125 VA, 120 to 277 VAC				

P74GA, P74HA

Pole Number	LINE-M2 (Main)				LINE-M1 (Auxiliary)			
	120 V	208 V	240 V	277 V	120 V	208 V	240 V	277 V
AC Full Load Amp	16.0	9.2	8.0	—	6.0	3.3	3.0	—
AC Locked Rotor Amp	96.0	55.2	48.0	—	36.0	19.8	18.0	—
AC Non-Inductive Amp	16.0	9.2	8.0	7.2	6.0	6.0	6.0	6.0
Pilot Duty, Both Poles — 125 VA, 120 to 600 VAC; 57.5 VA, 120 to 300 VDC								

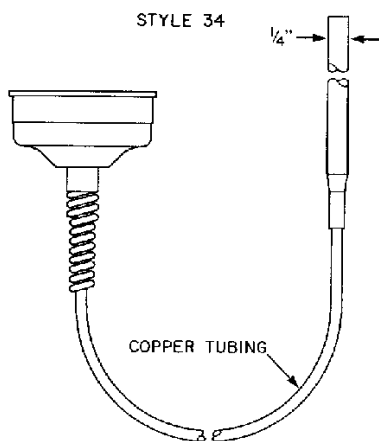
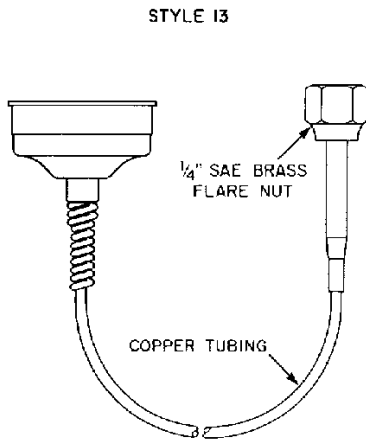
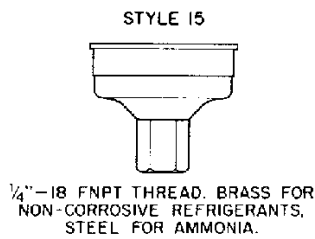
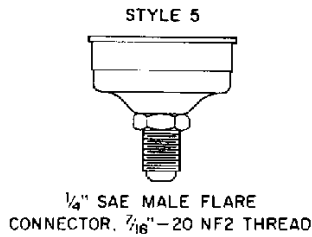


Fig. 2: Pressure element styles available on the P74. Style 13 is standard. Other styles shown above can be supplied on quantity orders.

Optional Constructions

Pressure Elements

Regularly supplied for non-corrosive refrigerants (fluorinated hydrocarbons). Available for ammonia service with 1/4 in. - 18 FNPT connector (See Style Chart, Fig. 2.)

Pressure Connectors

Standard controls supplied with 36 in. capillary tubing with 1/4 in. flare nut (Style 13). Controls with 1/4 in. SAE male flare connector (no capillary tubing, Style 5), 36 in. capillary tubing with 1/4 in. sweat section (Style 34), or 1/4 in. FNPT connector (Style 15) may be supplied on quantity orders (see Pressure Element Styles).

Repairs and Replacement

Field repairs must not be made. For a replacement control, contact the nearest Johnson Controls distributor.

Ordering Information

To order, specify:

1. Quantity required.

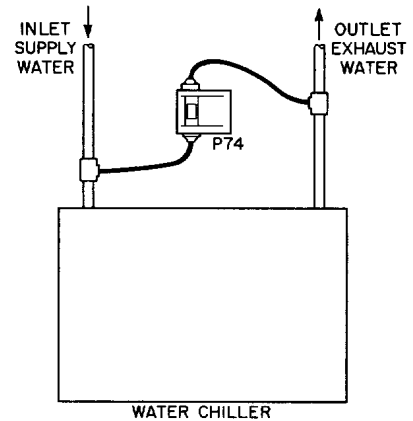


Fig. 3: Typical proof of flow hookup.

2. Complete Product Number, if available.
3. If complete Product Number is not available, specify Type Number (see Specifications table) and the following.
4. Type of refrigerant or fluid.
 - a. Non-corrosive.
 - b. Ammonia.
5. Style of pressure connector.
6. Optional constructions.
7. Setting -- contacts close at ____ and open at ____.

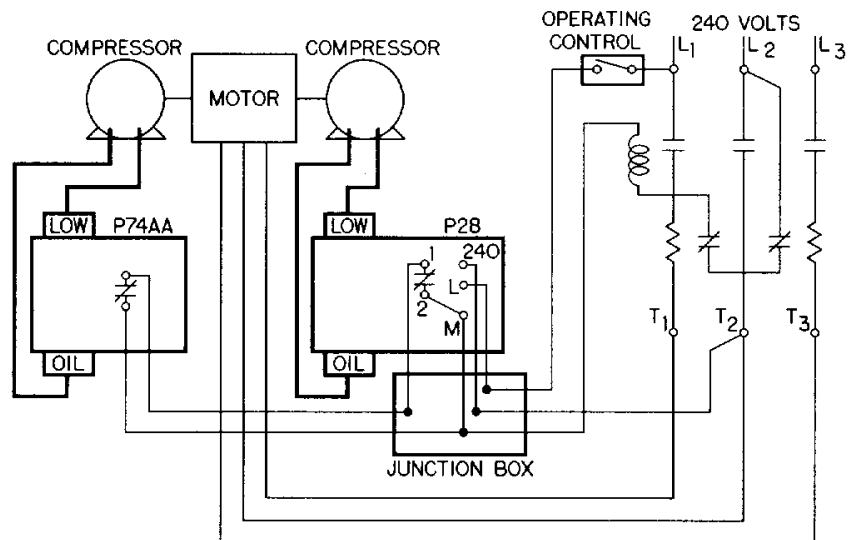
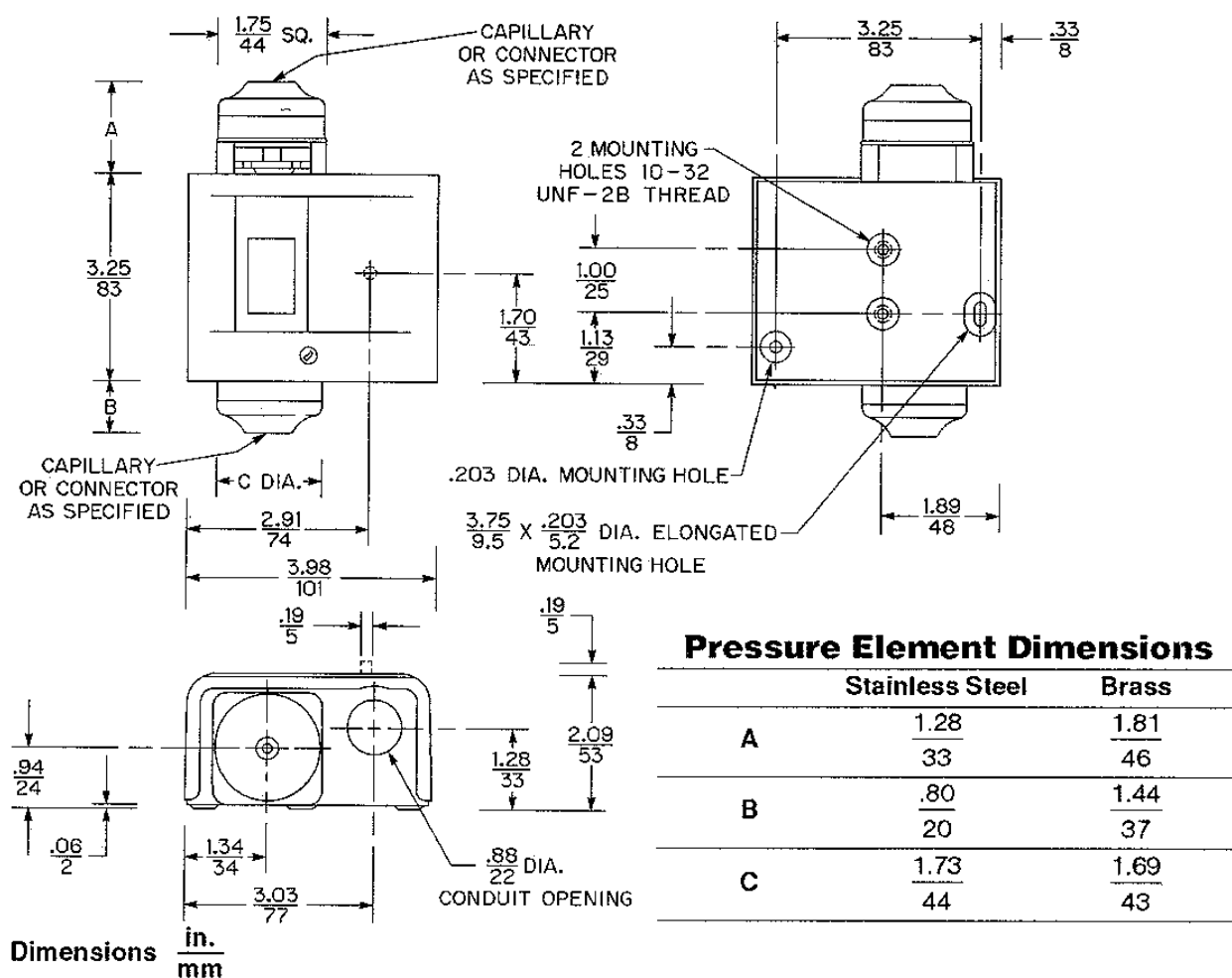


Fig. 4: Typical wiring diagram showing the P74AA and a P28 on a motor operating two compressors.



Performance specifications appearing herein are nominal and are subject to accepted manufacturing tolerances and application variables.

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CONTROLS**

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HANSEN TECHNOLOGIES CORPORATION



HCK4-4 Check Valve

INTRODUCTION

The HCK4 series of dependable, compact, rugged in-line check valves (disc type non-return valves) is ideally suited for refrigerant flow control applications. Valves open wide for flow in the arrow direction on the valve body. Valves close quickly and reliably when flow reversals occur.

Plated bodies and stainless steel seat discs and springs enable them to withstand expected industrial refrigeration conditions. Furthermore, these check valves can be mounted in any position, close-coupled to other valves, and use same flanges as Parker R/S, Frick, and Henry.

ADVANTAGES

These compact check valves offer reliable operation regardless of position. Corrosion resistant stainless steel seat disc. Metal-to-metal seats facilitate durable, tight closing of valves.

APPLICATIONS

These in-line check valves are designed to provide refrigerant flow control to hot gas lines, liquid lines, compressor discharge lines, suction lines, and hot gas heated drain pans.

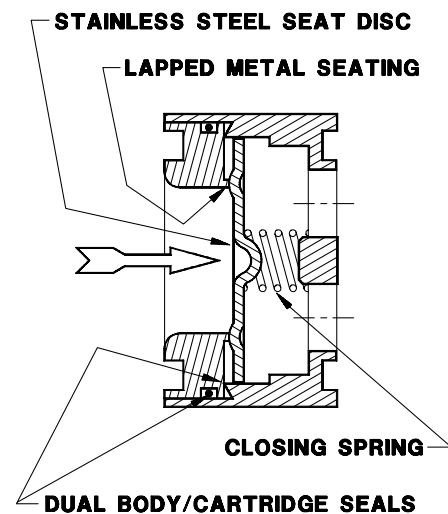
These valves are not recommended for use with pulsating loads such as low speed compressor discharge and screw compressor side port applications. For applications such as these, use Hansen HCK1 piston type check valves.

Specifications, Applications, Service Instructions & Parts

HCK4 IN-LINE CHECK VALVES $\frac{5}{8}$ " thru 4" PORT (16 thru 100 mm)

Flanged
 $\frac{3}{8}$ " thru 4"
FPT, SW, WN, ODS
for refrigerants

KEY FEATURES



ADDITIONAL FEATURES

Mounts in any position
Less than 1 PSID wide opening pressure
Can be close-coupled
Low bubble leakage tolerance
For Ammonia, R22, R134a, and other approved refrigerants
Dimensionally replaces R/S CK4A-2, -3, -4, -8, & -1 U.L. Listed

MATERIAL SPECIFICATIONS

Body:

5/8" thru 1 1/4": Steel, ASTM A108, zinc chromate plated

1 1/2" thru 4": Ductile iron, ASTM A536, zinc chromate plated

Seat Disc: Stainless steel

Seat Cartridge:

5/8" thru 1 1/4": Stainless steel, ASTM A582

1 1/2" thru 4": Steel, ASTM A108, zinc chromate plated

Spring: Stainless steel

Safe Working Pressure: 400 PSIG (27 bar)

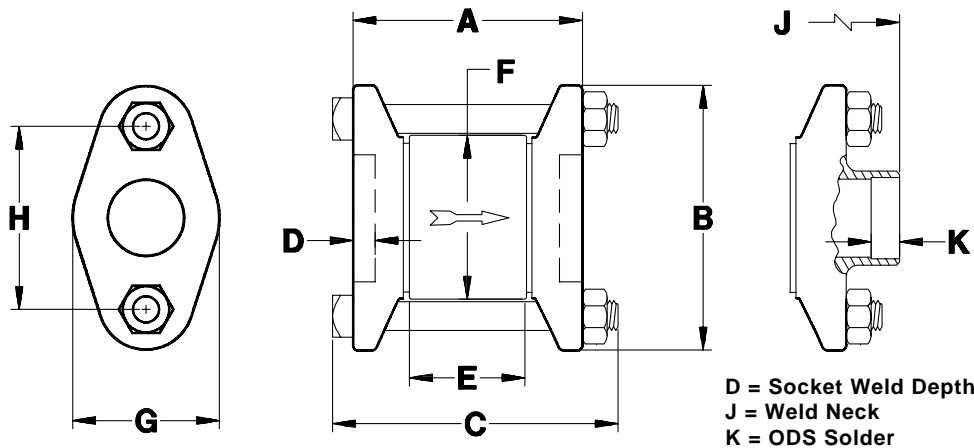
Operating Temperature: -60F to 240F (-50 to 115°C)

INSTALLATION

Valve may be located in any position. Arrow on valve body should match direction of flow. Secure valve with gaskets between flanges and tighten bolts evenly. Do not use this valve or any component to align pipes or tighten gap between flanges.

Do not install on inlet side of solenoid valves or control valves with electric shut-off or shut-off valves unless a relief valve is used from therein between piping. Do not install on inlet side of outlet pressure regulators where liquid may become trapped. Instead, check valves should be located on outlet side of these valves. Check valves can be close-coupled to other matching solenoid valves, pressure regulators, or strainers by using a Male Adapter Ring and longer bolts supplied when so specified on order.

INSTALLATION DIMENSIONS



D = Socket Weld Depth
J = Weld Neck
K = ODS Solder

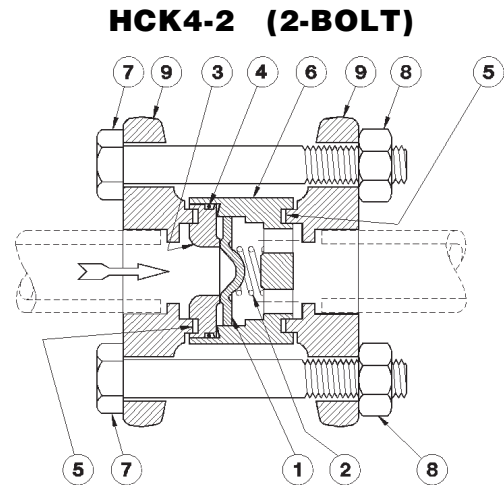
DIMENSION LETTER	HCK4-2* 5/8" PORT	HCK4-3* 3/4" PORT	HCK4-4* 1" PORT	HCK4-5 1 1/4" PORT	HCK4-7 1 1/2" PORT	HCK4-8* 2" PORT	HCK4-9 2 1/2" PORT	HCK4-0 3" PORT	HCK4-1* 4" PORT
A	2.50" (64 mm)	3.25" (83 mm)	3.25" (83 mm)	3.25" (83 mm)	5.06" (129 mm)	5.06" (129 mm)	6.06" (154 mm)	6.06" (154 mm)	6.39" (162 mm)
B	3.19" (81 mm)	4.50" (114 mm)	4.50" (114 mm)	4.50" (114 mm)	4.56" (116 mm)	4.56" (116 mm)	6.00" (152 mm)	6.00" (152 mm)	7.13" (181 mm)
C	3.50" (89 mm)	4.50" (114 mm)	4.50" (114 mm)	4.50" (114 mm)	6.38" (162 mm)	6.38" (162 mm)	7.50" (191 mm)	7.50" (191 mm)	8.00" (203 mm)
D	0.38" (10 mm)	0.50" (13 mm)	0.50" (13 mm)	0.50" (13 mm)	0.75" (19 mm)	0.75" (19 mm)	1.00" (25 mm)	1.00" (25 mm)	1.00" (25 mm)
E =	1.03" (26 mm)	1.22" (31 mm)	1.22" (31 mm)	1.22" (31 mm)	2.56" (65 mm)	2.56" (65 mm)	2.92" (74 mm)	2.92" (74 mm)	3.50" (89 mm)
F	1.50" (38 mm)	2.37" (60 mm)	2.37" (60 mm)	2.37" (60 mm)	3.62" (92 mm)	3.62" (92 mm)	4.84" (123 mm)	4.84" (123 mm)	6.06" (154 mm)
G	1.56" (40 mm)	2.50" (64 mm)	2.50" (64 mm)	2.50" (64 mm)	4.56" (116 mm)	4.56" (116 mm)	6.00" (152 mm)	6.00" (152 mm)	7.13" (181 mm)
H	2.19" (56 mm)	3.12" (79 mm)	3.12" (79 mm)	3.12" (79 mm)	3.06" (78 mm)	3.06" (78 mm)	4.00" (102 mm)	4.12" (105 mm)	5.00" (127 mm)
J	3.26" (83 mm)	4" (102 mm)	4" (102 mm)	4" (102 mm)	6.06" (154 mm)	6.06" (154 mm)	7.06" (179 mm)	7.06" (179 mm)	9.89" (251 mm)
K	0.33" (8 mm)	0.49" (12 mm)	0.59" (15 mm)	0.62" (16 mm)	0.71" (18 mm)	0.87" (22 mm)	0.96" (24 mm)	1.08" (27 mm)	1.40" (36 mm)
Valve Cv (Kv)	5.8 (5)	8.2 (7)	11.7 (10)	14.0 (12)	39 (33)	50 (43)	74 (63)	93 (80)	210 (180)
Pipe Size	1/2", 3/4"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"

*Dimensionally replaces R/S check valve models CK4A-2, -3, -4, -8, and -1. = "E" dimension is check valve body outside edge to outside edge. Flange groove depth: nominal 0.12" each of two; gasket thickness: nominal 0.06" each of two.

PARTS LIST

HCK4-2 (2-BOLT)

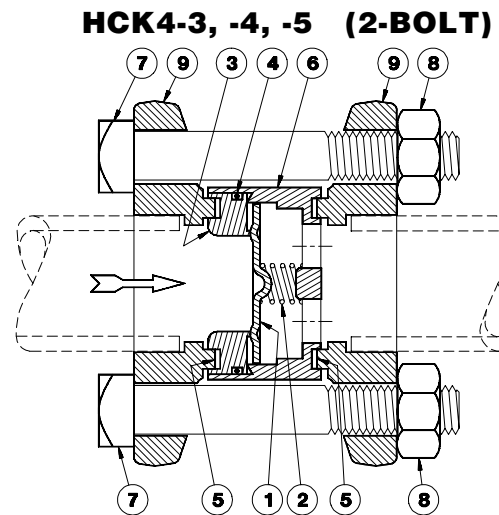
ITEM	DESCRIPTION	QTY	PART NO
	Valve Assembly Kit Above Kit Consists of:		
1	Seat Disc	1	72-0069
2	Closing Spring	1	72-0070
3	Seat Cartridge	1	72-0068
4	Seat Cartridge O-ring	1	72-0071
5	Flange Gasket	2	70-0065
6	Body, HCK4-2	1	72-0067
7	Bolt (7/16" - 14 x 3.25")	2	70-0225
8	Nut (7/16" - 14)	2	70-0055
9	Flange (FPT, SW, WN, ODS)	2	FACTORY



Socket weld shown. FPT, weld neck, ODS: available.

HCK4-3, -4, -5 (2-BOLT)

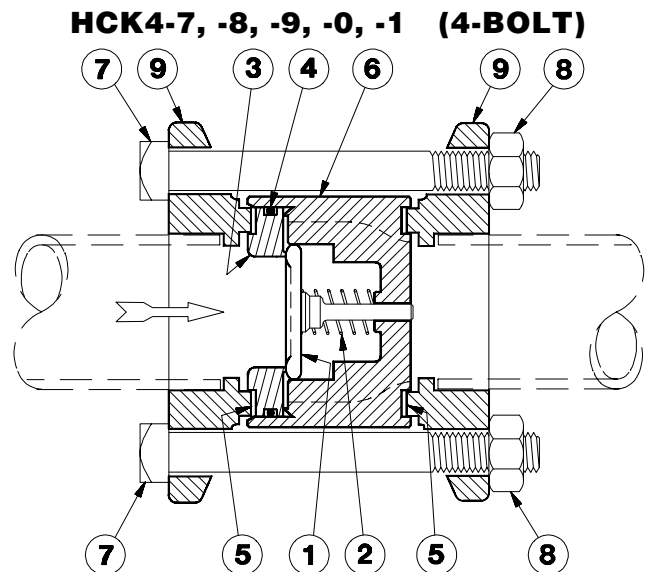
ITEM	DESCRIPTION	QTY	PART NO
	Valve Assembly Kit Above Kit Consists of:		
1	Seat Disc	1	72-0006
2	Closing Spring	1	70-0204
3	Seat Cartridge	1	72-0002
4	Seat Cartridge O-ring	1	72-0003
5	Flange Gasket	2	70-0132
6a	Body, HCK4-3	1	72-0004
6b	Body, HCK4-4	1	72-0008
6c	Body, HCK4-5	1	72-0001
7	Bolt (5/8" - 11 x 4")	2	72-0005
8	Nut (5/8" - 11)	2	70-0136
9	Flange (FPT, SW, WN, ODS)	2	FACTORY



Socket weld shown. FPT, weld neck, ODS: available.

HCK4-7, -8, -9, -0, -1 (4-BOLT)

ITEM	DESCRIPTION	QTY	PART NO
1a	Seat Disc 1½", 2"	1	72-0016
1b	Seat Disc 2½", 3"	1	72-0034
1c	Seat Disc 4"	1	72-0053
2a	Closing Spring 1½", 2"	1	72-0021
2b	Closing Spring 2½", 3"	1	72-0032
2c	Closing Spring 4"	1	72-0048
3a	Seat Cartridge 1½", 2"	1	72-0020
3b	Seat Cartridge 2½"	1	72-0029
3c	Seat Cartridge 3"	1	72-0028
3d	Seat Cartridge 4"	1	72-0047
4a	Seat Cartridge O-ring 1½", 2"	1	72-0017
4b	Seat Cartridge O-ring 2½", 3"	1	72-0027
4c	Seat Cartridge O-ring 4"	1	72-0049
5a	Flange Gasket 1½", 2"	2	75-0138
5b	Flange Gasket 2½"	2	75-0125
5c	Flange Gasket 3"	2	75-0137
5d	Flange Gasket 4"	2	75-0253
6a	Body, HCK4-7	1	72-0042
6b	Body, HCK4-8	1	72-0019
6c	Body, HCK4-9	1	72-0025
6d	Body, HCK4-0	1	72-0026
6e	Body, HCK4-1	1	72-0046
7a	Bolt, HCK4-7, -8 (5/8" - 11 x 6")	4	70-0268
7b	Bolt, HCK4-9, -0 (¾" - 10 x 7")	4	72-0033
7c	Bolt, HCK4-1 (7/8" - 9 x 7.5")	4	72-0051
8a	Nut, HCK4-7, -8 (5/8" - 11)	4	70-0136
8b	Nut, HCK4-9, -0 (¾" - 10)	4	75-0210
8c	Nut, HCK4-1 (7/8" - 9)	4	75-0280
9	Flange (FPT, SW, WN, ODS)	2	FACTORY



Socket weld shown. Weld neck, ODS: available.

OPERATION

HCK4 check valves are normally closed valves. As inlet pressure increases, it overcomes the closing spring force. As the seat disc is pushed back and away from the seat cartridge, flow through the valve occurs. The valve will remain open until the inlet pressure drops below the closing spring force or there is a flow reversal, at which time the seat disc will close against the seat cartridge, preventing reverse flow.

SIZING

Check valves are normally selected on the basis of line size. However, for gas flow applications at low load conditions, a minimum of 1 psid across the valve is essential. This will maintain valve at full open position. Valve Cv (Kv) is listed in the installation dimension table on page 2. Factory valve sizing assistance is available.

SERVICE AND MAINTENANCE

These valves are a reliable part of a refrigeration system. However, if valve does not appear to be operating satisfactorily, isolate it from the refrigeration system. Remove all refrigerant from associated piping and valves. Follow the guidelines in the caution section. Loosen each flange nut on the check valve. Break each flange gasket seal. Carefully loosen flange bolts one at a time, being cautious to avoid any refrigerant which still may be present. Remove check valve from flanges and inspect. Lapped seating surfaces should be smooth and free of pits or scratches.

To confirm valve operation, move seat disc with eraser end of pencil. Movement should be free from friction. If not, disassemble and visually inspect for dirt in valve or burrs on seat disc. Clean or replace parts as necessary. Valve discs and seats can be restored by lapping on a flat plate.

Reassemble valve and insert between flanges. Replace and tighten bolts and nuts evenly. Carefully check for leaks before returning to service.

CAUTION

Hansen check valves are only for refrigeration systems. These instructions and related safety precautions must be completely read and understood before selecting, using, or servicing these valves. Only knowledgeable, trained refrigeration mechanics should install, operate, or service these valves. Stated temperature and pressure limits should not be exceeded. Valves should not be removed unless system has been evacuated to zero pressure. See also Safety Precautions in current List Price Bulletin and Safety Precautions Sheet supplied with product. Escaping refrigerant might cause personal injury, particularly to the eyes and lungs.

WARRANTY

Hansen valves are guaranteed against defective materials or workmanship for one year F.O.B. our plant. No consequential damages or field labor is included.

ORDERING INFORMATION, HCK4 CHECK VALVES

TYPE	PORT SIZE (mm)	FLANGE CONNECTION STYLE & SIZES		
		FPT, SW, WN		ODS
		STD	ALSO	STD
HCK4-2*	5/8" (16)	1/2"	3/8", 3/4"	5/8"
HCK4-3*	3/4" (20)	3/4"	1", 1 1/4"	7/8"
HCK4-4*	1" (25)	1"	3/4", 1 1/4"	1 1/8"
HCK4-5	1 1/4" (32)	1 1/4"	3/4", 1"	1 3/8"
HCK4-7	1 1/2" (40)	1 1/2"	2"	1 5/8"
HCK4-8*	2" (50)	2"	1 1/2"	2 1/8"
HCK4-9	2 1/2" (65)	2 1/2"	3"	2 5/8"
HCK4-0	3" (80)	3"	--	3 1/8"
HCK4-1*	4" (100)	4"	--	4 1/8"

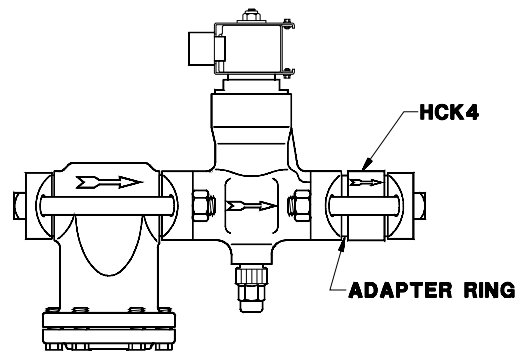
* Replaces R/S CK4A-2, CK4A-3, CK4A-4, CK4A-8, & CK4A-1. HCK4-2 close-couples to HS6 & HS8 Solenoid Valves. HCK4-3, -4, & -5 close-couples to HS7 Solenoid Valve. FPT available only 3/8" to 1 1/4".

TO ORDER: Specify valve type, connection style and size, and close-coupling information if needed.

TYPICAL SPECIFICATIONS

"Refrigeration in-line check valves shall have steel or ductile iron bodies, stainless steel seat discs, stainless steel closing springs, and be suitable for a safe working pressure of 400 PSIG, as manufactured by Hansen Technologies Corporation type HCK4 or approved equal."

Typical close-coupling to solenoid valve.



HANSEN TECHNOLOGIES CORPORATION

6827 High Grove Boulevard
Burr Ridge, Illinois 60527 U.S.A.
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WOOD'S

SURE-GRIP™

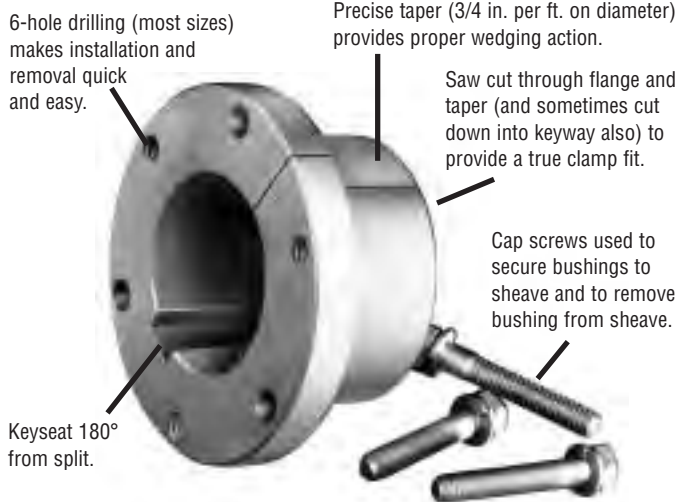
QD BUSHINGS

- **Provide a True Clamp Fit**
- **Are Easy to Install and Remove**
- **Permit Four-Way Mounting**



SURE-GRIP BUSHING FEATURES

Sure-Grip® “Quick Detachable” bushings are easy to install and remove. They are split through flange and taper to provide a true clamp on the shaft that is the equivalent of a shrink fit. All sizes except JA and QT have a setscrew over the key to help

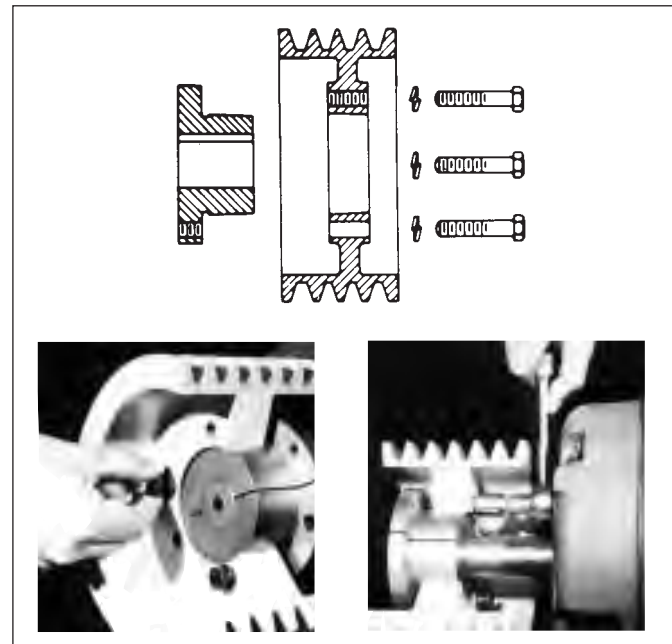


maintain the bushing's position on the shaft until the cap screws are securely tightened. Sure-Grip bushings have a very gradual taper (3/4-inch taper per ft. on the diameter) which is about half the inclined angle of many other bushings. The result is the Sure-Grip securely clamps the shaft, with twice the force of those competitive bushings, to provide extreme holding power.

Versatile Sure-Grip bushings permit the mounting of the same mating part on shafts of different diameters, and the mounting of different sheaves on the same shaft using the same bushing. Their interchangeability extends through sheaves, pulleys, timing pulleys, sprockets, flexible and rigid couplings, made-to-order items by Wood's, and to product lines of several other mechanical power transmission manufacturers.

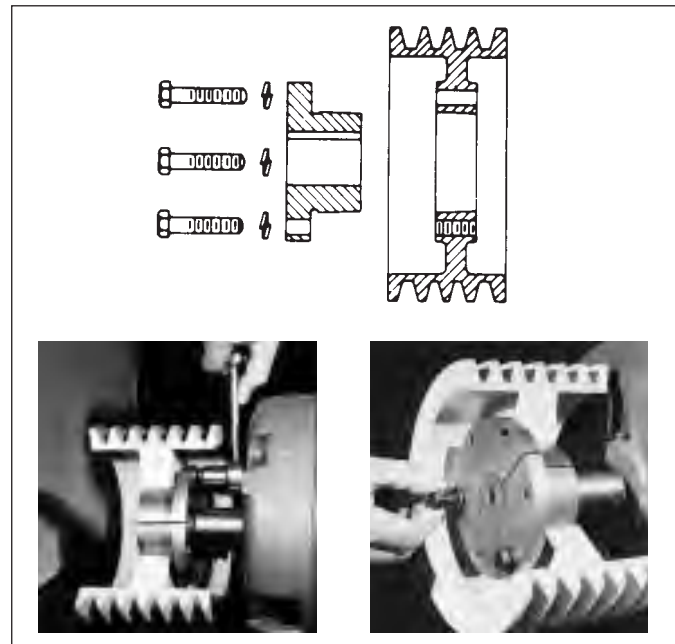
Sure-Grip bushings are manufactured with the drilled and tapped holes located at a precise distance from the keyseat; thus, a wide mating part having a bushing in each end can be mounted on a common shaft with the two keyways in line. This feature not only facilitates installation but also permits both bushings to carry an equal share of the load.

STANDARD MOUNTING



1. Cap screws from outside through drilled holes in the mating part and into threaded holes in the bushing flange located on the inside of the assembly. Or the complete assembly reversed on the shaft and;
2. Cap screws from inside through drilled holes in the mating part and into threaded holes in the bushing flange located on the outside of the assembly.

REVERSE MOUNTING

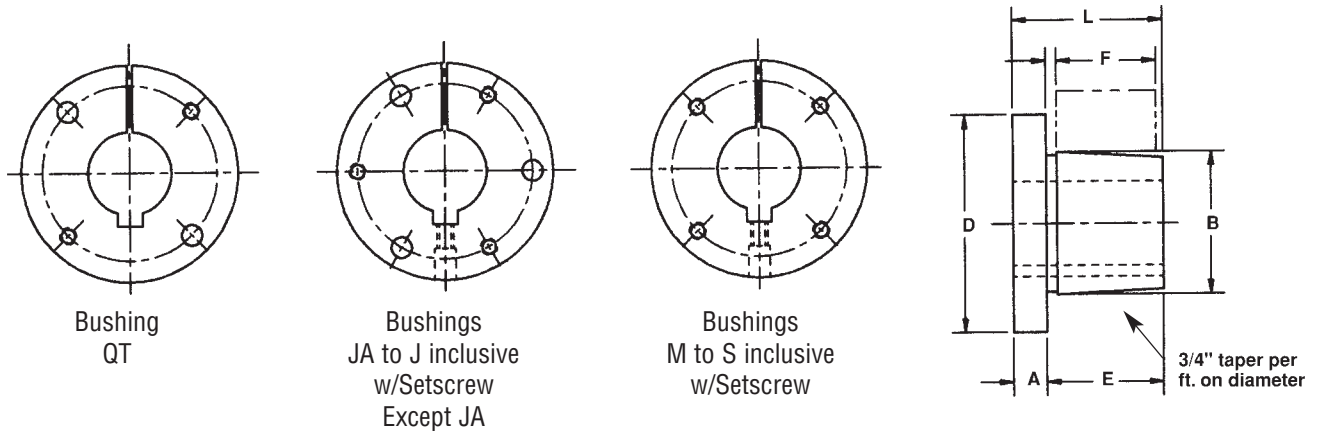


3. Cap screws from inside through drilled holes in the bushing flange located on the inside of the assembly and into threaded holes in the mating part.
4. Cap screws from outside through drilled holes in the bushing flange located on the outside of the assembly and into threaded holes in the mating part.

SURE-GRIP BUSHING DIMENSIONS



Sure-Grip bushings are designed to transmit the rated torque capacity listed in the table below when the cap screws are tightened as indicated. The bushings are stocked in all popular bore sizes, including metric bores, within the bore range for a particular bushing.



SURE-GRIP BUSHING TORQUE RATINGS AND DIMENSIONS

Bush.	Torque Capacity (In.-Lbs.)	(Note 1) Max. Bore	(Note 2) Max. Bore	DIMENSIONS IN INCHES						Bolt Circle	Cap Screws Required
				A	B	D	E	F*	L		
QT	1,750	1½	30	¼	1.625	2½	1	7/8	1¼	2	2-¼ x 1
JA	1,750	1¼	23	5/16	1.375	2	11/16	9/16	1	1 21/32	3 - #10 x 1
SH	3,500	1⅝	36	3/8	1.871	2 11/16	7/8	13/16	1¼	2¼	3-¼ x 1 3/8
SDS	5,000	1 15/16	42	7/16	2.1875	3 3/16	7/8	3/4	1 5/16	2 11/16	3-¼ x 1 3/8
SD	5,000	1 15/16	42	7/16	2.1875	3 3/16	1 3/8	1¼	1 13/16	2 11/16	3-¼ x 1 7/8
SK	7,000	2½	56	½	2.8125	3 7/8	1 3/8	1¼	1 7/8	3 5/16	3-5/16 x 2
SF	11,000	2 15/16	63	½	3.125	4 5/8	1½	1¼	2	3 7/8	3-3/8 x 2
E	20,000	3½	78	¾	3.834	6	1 7/8	1 5/8	2 5/8	5	3-½ x 2 3/4
F	40,000	3 15/16	90	13/16	4.4375	6 5/8	2 13/16	2½	3 5/8	5 5/8	3-9/16 x 3 5/8
J	55,000	4½	105	1	5.1484	7¼	3½	3 3/16	4½	6¼	3-5/8 x 4½
M	125,000	5½	130	1¼	6.500	9 1/8	5½	5 3/16	6 3/4	7 7/8	4-¾ x 6 3/4
N	150,000	6	140	1½	7.000	10	6 5/8	6¼	8 1/8	8½	4-7/8 x 8
P	250,000	7	160	1¾	8.250	11 3/4	7 5/8	7¼	9 3/8	10	4 - 1 x 9½
W	375,000	8½	200	2	10.437	15	9 3/8	9	11 3/8	12 3/4	4 - 1 1/8 x 11½
S	625,000	10	240	3¼	12.125	17 3/4	12½	12	15 3/4	15	5 - 1¼ x 15½

* Mating hub length.

1. MAX INCH BORE WITH KEYSEAT.
2. MAX MM BORE WITH STANDARD KEYSEAT.

See pages A1-4 to A1-8 for Bore and Keyseat information and weights.

SURE-GRIP BUSHINGS BORE AND KEYSEAT DIMENSIONS

(Inches)

Sure-Grip Bushings are available from stock with all the bores and keyseats listed below. In some cases, as the bore increases in diameter, a shallow keyseat is provided—due to insufficient metal thickness. When this happens, Wood's furnishes the correct rectangular key to suit at no charge. This does not affect the bushing's ability to transmit the load. The rectangular key, or flat key as some call it, fits into the standard keyway in the shaft.

Product No.	Bore	Key Seat	Wt. (*)
QT BUSHINGS			
QTMPB	7/16	No KS	.6
QT12	1/2	1/8 x 1/16	.6
QT9/16	9/16	1/8 x 1/16	.6
QT58	5/8	3/16 x 3/32	.6
QT11/16	11/16	3/16 x 3/32	.6
QT34	3/4	3/16 x 3/32	.6
QT13/16	13/16	3/16 x 3/32	.6
QT78	7/8	3/16 x 3/32	.6
QT15/16	15/16	1/4 x 1/8	.6
QT1	1	1/4 x 1/8	.6
QT1116	1-1/16	1/4 x 1/8	.6
QT118	1-1/8	1/4 x 1/8	.6
QT1316	1-3/16	1/4 x 1/8	.6
QT114	1-1/4	1/4 x 1/8	.6
QT1516	1-5/16	5/16 x 1/16	.6
QT138	1-3/8	5/16 x 1/16	.6
QT1716	1-7/16	3/8 x 1/16	.6
QT112	1-1/2	3/8 x 1/16	.6
JA BUSHINGS			
JAMPB	1/2	No KS	.8
JA12	1/2	1/8 x 1/16	.8
JA9/16	9/16	1/8 x 1/16	.8
JA58	5/8	3/16 x 3/32	.8
JA11/16	11/16	3/16 x 3/32	.8
JA34	3/4	3/16 x 3/32	.8
JA13/16	13/16	3/16 x 3/32	.8
JA78	7/8	3/16 x 3/32	.8
JA15/16	15/16	1/4 x 1/8	.8
JA1	1	1/4 x 1/8	.8
JA1116	1-1/16	1/4 x 1/16	.8
JA118	1-1/8	1/4 x 1/16	.8
JA1316	1-3/16	1/4 x 1/16	.8
JA114	1-1/4	1/4 x 1/32	.8
SH BUSHINGS			
SHMPB	7/16	No KS	1.1
SH12	1/2	1/8 x 1/16	1.1
SH9/16	9/16	1/8 x 1/16	1.1
SH58	5/8	3/16 x 3/32	1.1
SH11/16	11/16	3/16 x 3/32	1.0
SH34	3/4	3/16 x 3/32	1.0
SH13/16	13/16	3/16 x 3/32	1.0
SH78	7/8	3/16 x 3/32	1.0
SH15/16	15/16	1/4 x 1/8	1.0
SH1	1	1/4 x 1/8	.9

Product No.	Bore	Key Seat	Wt. (*)
SH BUSHINGS (continued)			
SH1116	1-1/16	1/4 x 1/8	.9
SH118	1-1/8	1/4 x 1/8	.9
SH1316	1-3/16	1/4 x 1/8	.8
SH114	1-1/4	1/4 x 1/8	.8
SH1516	1-5/16	5/16 x 5/32	.7
SH138	1-3/8	5/16 x 5/32	.7
SH1716	1-7/16	3/8 x 1/16	.7
SH112	1-1/2	3/8 x 1/16	.6
SH1916	1-9/16	3/8 x 1/4	.6
SH158	1-5/8	3/8 x 1/16	.5
SH11116	1-11/16	No KS	.5
SDS BUSHINGS			
SDSMPB	7/16	No KS	1.7
SDS12	1/2	1/8 x 1/16	1.7
SDS9/16	9/16	1/8 x 1/16	1.7
SDS58	5/8	3/16 x 3/32	1.6
SDS11/16	11/16	3/16 x 3/32	1.6
SDS34	3/4	3/16 x 3/32	1.6
SDS13/16	13/16	3/16 x 3/32	1.6
SDS78	7/8	3/16 x 3/32	1.5
SDS15/16	15/16	1/4 x 1/8	1.5
SDS1	1	1/4 x 1/8	1.5
SDS1116	1-1/16	1/4 x 1/8	1.4
SDS118	1-1/8	1/4 x 1/8	1.4
SDS1316	1-3/16	1/4 x 1/8	1.4
SDS114	1-1/4	1/4 x 1/8	1.3
SDS1516	1-5/16	5/16 x 5/32	1.3
SDS138	1-3/8	5/16 x 5/32	1.2
SDS13838KS	1-3/8	3/8 x 3/16	1.2
SDS1716	1-7/16	3/8 x 3/16	1.2
SDS112	1-1/2	3/8 x 3/16	1.1
SDS1916	1-9/16	3/8 x 3/16	1.1
SDS158	1-5/8	3/8 x 3/16	1.0
SDS11116	1-11/16	3/8 x 3/16	1.0
SDS134	1-3/4	3/8 x 1/8	1.0
SDS11316	1-13/16	1/2 x 1/8	.9
SDS178	1-7/8	1/2 x 1/16	.9
SDS11516	1-15/16	1/2 x 1/16	.8
SDS2	2	No KS	.7
SD BUSHINGS			
SDMPB	7/16	No KS	2.1
SD12	1/2	1/8 x 1/16	2.1
SD9/16	9/16	1/8 x 1/16	2.1
SD58	5/8	3/16 x 3/32	2.1
SD11/16	11/16	3/16 x 3/32	2.0

Product No.	Bore	Key Seat	Wt. (*)
SD BUSHINGS (continued)			
SD34	3/4	3/16 x 3/32	2.0
SD13/16	13/16	3/16 x 3/32	2.0
SD78	7/8	3/16 x 3/32	1.9
SD15/16	15/16	1/4 x 1/8	1.9
SD1	1	1/4 x 1/8	1.8
SD1116	1-1/16	1/4 x 1/8	1.8
SD118	1-1/8	1/4 x 1/8	1.7
SD1316	1-3/16	1/4 x 1/8	1.7
SD114	1-1/4	1/4 x 1/8	1.6
SD1516	1-5/16	5/16 x 5/32	1.6
SD138	1-3/8	5/16 x 5/32	1.5
SD13838KS	1-3/8	3/8 x 3/16	1.5
SD1716	1-7/16	3/8 x 3/16	1.4
SD112	1-1/2	3/8 x 3/16	1.4
SD1916	1-9/16	3/8 x 3/16	1.3
SD158	1-5/8	3/8 x 3/16	1.2
SD11116	1-11/16	3/8 x 3/16	1.2
SD134	1-3/4	3/8 x 1/8	1.1
SD11316	1-13/16	1/2 x 1/8	1.1
SD178	1-7/8	1/2 x 1/16	1.0
SD11516	1-15/16	1/2 x 1/16	.9
SD2	2	No KS	.8
SK BUSHINGS			
SKMPB	7/16	No KS	3.6
SK12	1/2	1/8 x 1/16	3.6
SK9/16	9/16	1/8 x 1/16	3.6
SK58	5/8	3/16 x 3/32	3.6
SK11/16	11/16	3/16 x 3/32	3.5
SK34	3/4	3/16 x 3/32	3.5
SK13/16	13/16	3/16 x 3/32	3.5
SK78	7/8	3/16 x 3/32	3.4
SK15/16	15/16	1/4 x 1/8	3.4
SK1	1	1/4 x 1/8	3.3
SK1116	1-1/16	1/4 x 1/8	3.3
SK118	1-1/8	1/4 x 1/8	3.2
SK1316	1-3/16	1/4 x 1/8	3.2
SK114	1-1/4	1/4 x 1/8	3.1
SK1516	1-5/16	5/16 x 5/32	3.1
SK151638KS	1-5/16	3/8 x 3/16	3.1
SK138	1-3/8	5/16 x 5/32	3.0
SK13838KS	1-3/8	3/8 x 3/16	3.0
SK1716	1-7/16	3/8 x 3/16	2.9
SK112	1-1/2	3/8 x 3/16	2.9
SK1916	1-9/16	3/8 x 3/16	2.8
SK158	1-5/8	3/8 x 3/16	2.7
SK11116	1-11/16	3/8 x 3/16	2.6
SK134	1-3/4	3/8 x 3/16	2.5
SK13412KS	1-3/4	1/2 x 1/4	2.5

* Approximate weight in lbs.

MPB Bushings are unsplit.

(Continued—next page)

SURE-GRIP BUSHINGS BORE AND KEYSEAT DIMENSIONS



(Inches)

Product No.	Bore	Key Seat	Wt. (*)
SK BUSHINGS (continued)			
SK11316	1-13/16	1/2 x 1/4	2.4
SK178	1-7/8	1/2 x 1/4	2.4
SK11516	1-15/16	1/2 x 1/4	2.3
SK2	2	1/2 x 1/4	2.2
SK2116	2-1/16	1/2 x 1/4	2.1
SK218	2-1/8	1/2 x 1/4	2.0
SK2316	2-3/16	1/2 x 1/8	2.0
SK214	2-1/4	1/2 x 1/8	1.9
SK21458KS	2-1/4	5/8 x 1/8	1.9
SK2516	2-5/16	5/8 x 1/16	1.8
SK238	2-3/8	5/8 x 1/16	1.7
SK2716	2-7/16	5/8 x 1/16	1.6
SK212	2-1/2	5/8 x 1/16	1.5
SK2916	2-9/16	No KS	1.3
SK258	2-5/8	No KS	1.1
SF BUSHINGS			
SFMPB	1/2	No KS	5.1
SF12	1/2	1/8 x 1/16	5.1
SF58	5/8	3/16 x 3/32	5.0
SF34	3/4	3/16 x 3/32	5.0
SF78	7/8	3/16 x 3/32	4.9
SF15/16	15/16	1/4 x 1/8	4.8
SF1	1	1/4 x 1/8	4.8
SF1116	1-1/16	1/4 x 1/8	4.7
SF118	1-1/8	1/4 x 1/8	4.7
SF1316	1-3/16	1/4 x 1/8	4.6
SF114	1-1/4	1/4 x 1/8	4.5
SF1516	1-5/16	5/16 x 5/32	4.5
SF138	1-3/8	5/16 x 5/32	4.4
SF13838KS	1-3/8	3/8 x 3/16	4.4
SF1716	1-7/16	3/8 x 3/16	4.3
SF112	1-1/2	3/8 x 3/16	4.2
SF1916	1-9/16	3/8 x 3/16	4.2
SF158	1-5/8	3/8 x 3/16	4.1
SF11116	1-11/16	3/8 x 3/16	4.0
SF134	1-3/4	3/8 x 3/16	3.9
SF11316	1-13/16	1/2 x 1/4	3.8
SF178	1-7/8	1/2 x 1/4	3.7
SF11516	1-15/16	1/2 x 1/4	3.6
SF2	2	1/2 x 1/4	3.5
SF2116	2-1/16	1/2 x 1/4	3.4
SF218	2-1/8	1/2 x 1/4	3.3
SF2316	2-3/16	1/2 x 1/4	3.2
SF214	2-1/4	1/2 x 1/4	3.1
SF21458KS	2-1/4	5/8 x 5/16	3.1
SF2516	2-5/16	5/8 x 3/16	3.1
SF238	2-3/8	5/8 x 3/16	3.0
SF2716	2-7/16	5/8 x 3/16	2.9
SF212	2-1/2	5/8 x 3/16	2.8
SF2916	2-9/16	5/8 x 1/16	2.6
SF258	2-5/8	5/8 x 1/16	2.5
SF21116	2-11/16	5/8 x 1/16	2.4
SF234	2-3/4	5/8 x 1/16	2.2
SF278	2-7/8	3/4 x 1/16	1.8
SF21516	2-15/16	3/4 x 1/32	1.7

Product No.	Bore	Key Seat	Wt. (*)
E BUSHINGS			
EMPB	7/8	No KS	10.8
E78	7/8	3/16 x 3/32	10.8
E15/16	15/16	1/4 x 1/8	10.8
E1	1	1/4 x 1/8	10.7
E118	1-1/8	1/4 x 1/8	10.6
E1316	1-3/16	1/4 x 1/8	10.5
E114	1-1/4	1/4 x 1/8	10.4
E1516	1-5/16	5/16 x 5/32	10.3
E138	1-3/8	5/16 x 5/32	10.2
E13838KS	1-3/8	3/8 x 3/16	10.2
E1716	1-7/16	3/8 x 3/16	10.1
E112	1-1/2	3/8 x 3/16	10.0
E1916	1-9/16	3/8 x 3/16	9.9
E158	1-5/8	3/8 x 3/16	9.8
E11116	1-11/16	3/8 x 3/16	9.7
E134	1-3/4	3/8 x 3/16	9.6
E11316	1-13/16	1/2 x 1/4	9.4
E178	1-7/8	1/2 x 1/4	9.3
E11516	1-15/16	1/2 x 1/4	9.2
E2	2	1/2 x 1/4	9.0
E2116	2-1/16	1/2 x 1/4	8.9
E218	2-1/8	1/2 x 1/4	8.8
E2316	2-3/16	1/2 x 1/4	8.6
E214	2-1/4	1/2 x 1/4	8.5
E21458KS	2-1/4	5/8 x 5/16	8.5
E2516	2-5/16	5/8 x 5/16	8.3
E238	2-3/8	5/8 x 5/16	8.1
E2716	2-7/16	5/8 x 5/16	8.0
E212	2-1/2	5/8 x 5/16	7.8
E2916	2-9/16	5/8 x 5/16	7.6
E258	2-5/8	5/8 x 5/16	7.5
E1116	2-11/16	5/8 x 5/16	7.3
E234	2-3/4	5/8 x 5/16	7.1
E21316	2-13/16	3/4 x 3/8	7.2
E278	2-7/8	3/4 x 3/8	7.1
E21516	2-15/16	3/4 x 1/8	6.9
E3	3	3/4 x 1/8	6.7
E318	3-1/8	3/4 x 1/8	6.3
E3316	3-3/16	3/4 x 1/8	6.0
E314	3-1/4	3/4 x 1/8	5.8
E3516	3-5/16	7/8 x 1/16	5.7
E338	3-3/8	7/8 x 1/16	5.5
E3716	3-7/16	7/8 x 1/16	5.2
E312	3-1/2	7/8 x 1/16	4.7
F BUSHINGS			
FMPB	1	No KS	17.9
F1	1	1/4 x 1/8	17.9
F118	1-1/8	1/4 x 1/8	17.7
F1316	1-3/16	1/4 x 1/8	17.6
F114	1-1/4	1/4 x 1/8	17.5
F138	1-3/8	5/16 x 5/32	17.2
F1716	1-7/16	3/8 x 3/16	17.1
F112	1-1/2	3/8 x 3/16	16.9
F1916	1-9/16	3/8 x 3/16	16.8
F158	1-5/8	3/8 x 3/16	16.7

Product No.	Bore	Key Seat	Wt. (*)
F BUSHINGS (continued)			
F134	1-3/4	3/8 x 3/16	16.3
F178	1-7/8	1/2 x 1/4	16.0
F11516	1-15/16	1/2 x 1/4	15.8
F2	2	1/2 x 1/4	15.6
F2116	2-1/16	1/2 x 1/4	15.4
F218	2-1/8	1/2 x 1/4	15.2
F2316	2-3/16	1/2 x 1/4	15.0
F214	2-1/4	1/2 x 1/4	14.8
F21458KS	2-1/4	5/8 x 5/16	14.8
F2516	2-5/16	5/8 x 5/16	14.5
F238	2-3/8	5/8 x 5/16	14.3
F2716	2-7/16	5/8 x 5/16	14.1
F212	2-1/2	5/8 x 5/16	13.9
F2916	2-9/16	5/8 x 5/16	13.7
F258	2-5/8	5/8 x 5/16	13.4
F21116	2-11/16	5/8 x 5/16	13.2
F234	2-3/4	5/8 x 5/16	12.9
F21316	2-13/16	3/4 x 3/8	12.6
F278	2-7/8	3/4 x 3/8	12.3
F21516	2-15/16	3/4 x 3/8	12.1
F3	3	3/4 x 3/8	11.8
F318	3-1/8	3/4 x 3/8	11.2
F3316	3-3/16	3/4 x 3/8	10.9
F314	3-1/4	3/4 x 3/8	10.6
F3516	3-5/16	7/8 x 3/16	11.0
F338	3-3/8	7/8 x 3/16	10.6
F3716	3-7/16	7/8 x 3/16	10.3
F312	3-1/2	7/8 x 3/16	10.0
F358	3-5/8	7/8 x 3/16	9.4
F31116	3-11/16	7/8 x 3/16	9.0
F334	3-3/4	7/8 x 3/16	8.7
F378	3-7/8	1 x 1/8	8.1
F31516	3-15/16	1 x 1/8	7.7
F4	4	No KS	6.9
J BUSHINGS			
JMPB	1-7/16	No KS	28.1
J1716	1-7/16	3/8 x 3/16	28.1
J112	1-1/2	3/8 x 3/16	28.0
J1916	1-9/16	3/8 x 3/16	27.8
J11116	1-11/16	3/8 x 3/16	27.4
J134	1-3/4	3/8 x 3/16	27.2
J178	1-7/8	1/2 x 1/4	26.7
J11516	1-15/16	1/2 x 1/4	26.5
J2	2	1/2 x 1/4	26.3
J218	2-1/8	1/2 x 1/4	25.8
J2316	2-3/16	1/2 x 1/4	25.6
J214	2-1/4	1/2 x 1/4	25.3
J2516	2-5/16	5/8 x 5/16	25.0
J238	2-3/8	5/8 x 5/16	24.7
J2716	2-7/16	5/8 x 5/16	24.5
J212	2-1/2	5/8 x 5/16	24.2
J258	2-5/8	5/8 x 5/16	23.6
J21116	2-11/16	5/8 x 5/16	23.3
J234	2-3/4	5/8 x 5/16	23.0
J278	2-7/8	3/4 x 3/8	22.2

* Approximate weight in lbs.

MPB Bushings are unsplit.

(Continued—next page)

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

SERVICE SECTION

TABLE OF CONTENTS

<u>PAGE</u>	
1	GENERAL SERVICE INSTRUCTIONS
1	General Comments
1	Preparation Of Compressor For Servicing
1	Refrigerant 717 (Ammonia) Compressor
1	Halocarbon Refrigerant Compressor
2	Compressor Oil Removal
2	Preparation Of Compressor For Initial Start After Servicing
2	CYLINDER COVERS
2	Disassembly
3	Assembly
3	SUCTION AND DISCHARGE VALVE PLATES
3	Disassembly
3	440 Compressor (Mushroom Style)
4	450, 450XL Compressor (Bullet Style)
4	Reassembly
4	440 Compressor (Mushroom Style)
7	450, 450XL Compressor (Mushroom Style)
7	COMPRESSOR DRIVE TYPES
7	V-Belt Drive Compressors
7	Belt Removal
7	Flywheel Removal
8	Sheave Removal
8	Drive Inspection
9	Drive Installation
10	Drive Alignment
11	Belt Tension
11	Single 5V, V-Belts
11	Banded 5V, V-Belts
12	Direct Drive Compressors
12	Coupling Removal
12	Coupling Replacement
12	CAPACITY CONTROL
12	Old Style (Mushroom Type)
12	Lift Pins, Ring and Springs Removal
14	Actuator Mechanism Removal
14	Actuator Mechanism Replacement
14	New Style (Bullet Type)
14	Lift Pins, Ring and Springs Removal
14	Unloader Piston Removal
16	Unloader Piston Replacement
16	Actuator Mechanism Removal
16	Actuator Mechanism Replacement

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

SERVICE SECTION

TABLE OF CONTENTS (cont'd)

<u>PAGE</u>	
16	SAFETY VALVE (INTERNAL RELIEF)
16	Removal
16	Replacement
17	OIL PRESSURE ADJUSTMENT ASSEMBLY
17	Disassembly
17	Reassembly
17	Adjustment
17	TRI-MICRO[®] OIL FILTER
17	Removal
17	Replacement
18	OIL PUMP ASSEMBLY
18	Removal
18	Replacement
18	PREPARATION FOR INTERNAL SERVICING
18	Handhole Cover Removal
18	Handhole Cover Replacement
19	CRANKSHAFT SEAL
19	Oil Seal Leakage
19	Removal
19	Installing A New Shaft Seal
19	CONNECTING RODS AND PISTONS
20	Disassembly
20	440 & 450 VMC Compressors Only
20	450XL VMC Compressor Only
20	Reassembly
23	CONNECTING RODS AND PISTONS
23	Disassembly
23	440 & 450 VMC Compressors Only
23	450XL VMC Compressor Only
23	Reassembly
23	CYLINDER LINERS
23	Removal
24	Lift Rings For Unloading
24	440 Lift Ring Assembly
24	450/450XL Lift Ring Assembly
24	Installation Of Liners
24	CRANKSHAFT
25	General
25	Removal From Drive End
25	Removal From The Pump End
25	Servicing The Center Bearing (12 & 16 Cylinders)
26	Reinstallation
27	MODIFICATION TO FRONT BEARING RETAINER AND FRONT BEARING COVER (440 Compressor Only)
31	CONNECTING ROD NUTS TIGHTENING INSTRUCTIONS - VMC COMPRESSORS

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

SERVICE SECTION

ILLUSTRATIONS AND TABLES

<u>PAGE</u>	<u>FIGURE</u>	
3	1	Bearing And Cylinder Covers Assembly & Disassembly Stud
5	2	Upper Cylinder Cross Section
6	3	Discharge Diaphragm Valve Placement
8	4	Flywheel Removal Tool
9	5	Unit Belting Requirements Due To Horsepower
11	6	Belt Tension Spring Scale
13	7	Typical Capacity Control Mechanism Arrangement – 440 Compressor (Old Style Mushroom Type)
15	8	Typical Capacity Control Mechanism Arrangement – 450 & 450XL Compressors (New Style Bullet Type)
16	9	Safety Valve Location
20	10	Piston Ring Compressing Tool
21	11	Front Cover Assembly And Disassembly Tool
22	12	Crankshaft Seal Assembly
23	13	Piston Ring Dimensions
24	14	Cylinder Liner Assembly Tool
25	15	Cylinder Liner Removal Tool
27	16	Retainer Partial Vertical Cross Section
36	17	Typical 400 Series Compressor Vertical Cross section And Lubrication System

<u>PAGE</u>	<u>TABLE</u>	
23	1	Piston Ring Dimensions And Tolerances
28	2	Torque Specifications – VMC Model 440
29	3	Torque Specifications – VMC Model 450
30	4	Torque Specifications – VMC Model 450XL
32	5	Factory Running Dimensions Tolerances, Clearances & Allowable Wear Limits For 440, 450 & 450XL VMC Compressors

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

I. GENERAL SERVICE INSTRUCTIONS

A. General Comments

When working on the compressor, care must be taken to ensure contaminants, such as water from melting ice or snow, dirt, and dust, DO NOT enter the compressor while it is being serviced. It is essential that all dust, oil or ice that has accumulated on the outside of the compressor be removed before servicing.

All gaskets, o-rings, roll pins and lock washers must be replaced when servicing and reassembling the compressor.

As an aid in servicing compressors, a tool kit is available and can be ordered as Vilter Part No. KT067. This kit includes necessary wrenches as well as all the servicing tools pictured in this section.

B. Preparation Of Compressor For Servicing

Remove all refrigerant from the compressor before servicing it. To properly evacuate the compressor, employ the following procedure:

1. Refrigerant 717 (Ammonia) Compressor

Shut down the unit, open the electrical disconnect switch and pull the fuses for the compressor motor to prevent the unit from starting. Put a lock on the disconnect switch and tag the switch to indicate maintenance is being performed.

Isolate the unit by manually closing the discharge stop/check valve. Close the liquid supply valves and open all solenoid valves to prevent liquid refrigerant from being trapped between the stop valves and solenoid valves. Allow the unit to equalize to suction pressure before closing the suction

stop/check valve. After the unit has equalized to suction pressure, depressurize the unit by using a pump down compressor or other acceptable means.

Remove drain plugs from the bearing housings, compressor housing and discharge manifold. Drain the oil into appropriate containers.

To blow off the gas caught between the discharge valves and discharge stop valve, close the gauge valve, remove gauge, connect one end of a hose to gauge valve, and put the other end in a bucket of water. Open the valve slowly and the water will absorb any discharged ammonia.

Connect hose to the suction gauge connection in the same manner, and the water will absorb the rest of the ammonia. Do not leave hoses in the water if work has to stop and the frame is still warm. Cooling of the frame could siphon water back into the frame through the hose.

2. Halocarbon Refrigerant Compressor

The procedure for removing halocarbon refrigerant from a compressor is NOT the same as described for an ammonia compressor. To evacuate a compressor using halocarbon refrigerant, employ certified technicians to pump down the unit according to applicable laws and ordinances.

When the unit is pumped down, the temperature of the machine drops. Before opening the machine, allow it to warm up to room temperature. Opening the machine before it is warmed up produces condensation on the metal surfaces. Moisture is detrimental to compressor operation. It leads to system operating difficulties and rusting of parts.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

3. Compressor Oil Removal

If service will be performed on unloader solenoids, oil filter change, suction or discharge valves, or crankshaft seal, the oil will not require removal. If it becomes necessary to open the crankcase, disconnect power to the heater and remove oil through the drain valve.

If a slight positive pressure is allowed to remain in the crankcase before compressor is opened, it will force the oil from the drain valve into a container of sufficient capacity. It is best to have reduced the pressure to 2 psig (13.79 kPa) to minimize the amount of foaming.

After the compressor has been serviced, do not reuse this oil. Even reconditioned oil contains contaminants that could cause compressor damage.

C. **Preparation Of Compressor For Initial Start After Servicing**

Vilter recommends charging 1 to 2 gallons of fresh oil into the compressor via the oil pressure gauge port in the front housing. This eliminates "dry start-up" by forcing oil into the passageways in the crankshaft, to the connecting rods, and having a good supply of oil for the shaft seal. Add oil to crankcase, via drain valve, to within 1/2 of the sight glass in the handhole cover. Connect power to the crankcase heater, close all open valves, and check for leaks.

When oil has reached approximately 100°F (37.8°C), start the compressor and allow it to pull the load down gradually. Run the compressor for a few minutes, then stop for a cooling off period. Restart and run for a longer time. Stop and allow for a cooling off period again.

Lengthen each running period until it is determined no moving parts are heating up excessively.

When the compressor operates with normal running temperatures, allow it to run for whatever length of time the load requires. With new or replacement compressors, the suction bag should be removed after running for 24 hours.

II. **CYLINDER COVERS**

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

A. **Disassembly**

To remove the compressor cylinder covers, remove the capacity control lines and water lines (or liquid cooling lines, if any) from the covers that will be removed. Next, remove two screws that are opposite each other diagonally across the cover (i.e. two screws by water connections). Install two assembly studs into these holes and tighten them to thread bottom. Screw on nuts to within one thread of touching the cover. Remove the other screws. Slowly back the two nuts off and make sure the cover follows.

If the cover doesn't follow, STOP. **DO NOT** back off nuts more than one turn. Break the gasket seal and then continue cover removal.

The studs are long enough to relieve all the spring tension before the nuts are removed. Remember, the studs must not be turned out with the nuts. After all of the spring tension is removed, the nuts can be removed, covers lifted off and head springs removed. It is best to keep all parts in the correct cylinder assignment. Invert the cover and place on work surface, placing each spring in its corresponding location in the cover.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

A. Disassembly (cont'd)

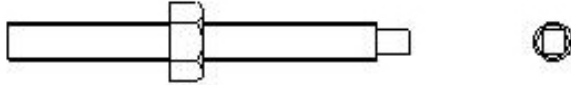


FIGURE 1. BEARING AND CYLINDER COVERS ASSEMBLY & DISASSEMBLY STUD

B. Assembly

Before replacing the cover on the compressor, inspect the gasket surfaces of the cover and compressor frame. Remove any debris adhering to either of these surfaces. Remove any burrs or rough edges from the mating surfaces to ensure a tight seal. Replace studs, if removed. Lightly lubricate both sides of the head gasket. Position the gasket over the studs and against the compressor frame in the correct orientation. Place the springs on top of the safety head yokes (rotating the spring until it stays on the yoke). Place the cover down over the studs and slowly lower on top of springs. When all pieces are in alignment, place the nuts on the studs and start to tighten. When the cover is secure within $1\frac{1}{4}$ " (31.75 mm) of the gasket, install the rest of the screws so they come in contact with the cover. This will ensure they will not cross thread in the holes.

Do not tighten each screw separately, however. Alternate on opposing screws, until the cover is seated on the gasket. Remove the studs and replace with screws. Finish tightening the screws in an opposing pattern to the recommended torque values shown in Table 2, 3 or 4 (depending upon your compressor model). Reinstall the capacity control and head cooling lines, and check for leaks.

III. SUCTION AND DISCHARGE VALVE PLATES

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

A. Disassembly

To service valve plates in the compressor, remove the cylinder covers (refer to paragraph II.A). In cylinders without unloaders, the valve assemblies may be removed as soon as the covers are removed.

On compressor cylinders equipped with unloaders, the unloader needs to be forced down before the valves are serviced. If the unloader remains up, the suction valve is forced off its seat, and will not seat and locate properly during reassembly. To hold the unloader mechanism down, remove the plug from the hole 'B' in the frame. Force the unloader piston down and insert a short $\frac{5}{16}$ " (7.93 mm) diameter metal rod through the hole to restrain the piston. Use a wooden block to force the piston down to avoid scratching or damaging the top of the unloader piston. Once the piston is held down, the valve assemblies can be serviced.

1. 440 Compressor (Mushroom Style) (See Figure 7)

Lift out the safety head yoke, which holds the safety head assembly in place. When the yoke is out, lift out the safety head assembly and suction valve plate.

To disassemble the safety head assembly, remove the locknut on the valve retaining screw.

1. 440 Compressor (Mushroom Style) (cont'd)

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

Lift off the washer, two diaphragm valves, spacer and last diaphragm valve. Turn the safety head assembly over and remove the valve retaining screw. Remove the helical suction valve springs from their sockets with a twisting, pulling motion.

2. 450, 450XL Compressor (Bullet Style) (See Figure 8)

Lift out the safety head yoke, which holds the safety head assembly in place. Invert the yoke to make sure all eight coil springs are intact within it. If any springs are broken, locate and remove pieces. Springs can be removed and replaced without tools. Since they are only finger tight in the bottom of the hole, they can be removed with a twisting, pulling motion.

After the safety yoke has been removed, lift out the ring plate discharge valve (refer to note below). Slip the safety head up and off the roll pin that guides it.

NOTE:

Before removing valve plates, look for the word "TOP" etched on each plate and ring plate discharge valve. This denotes the unlapped upper face. If the etching is not clearly visible, dot the upper face of the valve plate with dye or tape. Do this sparingly. Any marking applied must be removed prior to reassembly.

The safety head contains four helical suction valve springs, which are identical to the eight discharge valve springs. These need to be kept separated. The suction valve can be lifted out.

Before reassembling the safety head assembly, the "top" of the discharge diaphragm valve must be determined. Place a straight edge on the diaphragms to reveal the dome. Diaphragms are installed with the dome on top. All pieces of the safety head assembly should be clean and lightly lubricated with compressor oil before reassembly.

To reassemble the safety head assembly, insert the valve retaining screw in the safety head. Place one of the domed discharge diaphragm valves on the screw, making sure the dome is up. Next, place the thin spacer on the screw. Follow it with the two remaining diaphragms, both having the dome on top. Place the thicker washer and nut on the valve retaining screw. Tighten the nut to the torque value listed in Table 2, 3 or 4 (depending upon compressor model).

Place the suction valve springs into the holes with the end that has two coils wound towards the bottom of the hole, and twist. The springs lock in place. When the springs are properly installed, the safety head can be inverted without the springs falling out. Place the suction valve plate in the cavity of the cylinder liner with the side marked "TOP" facing up.

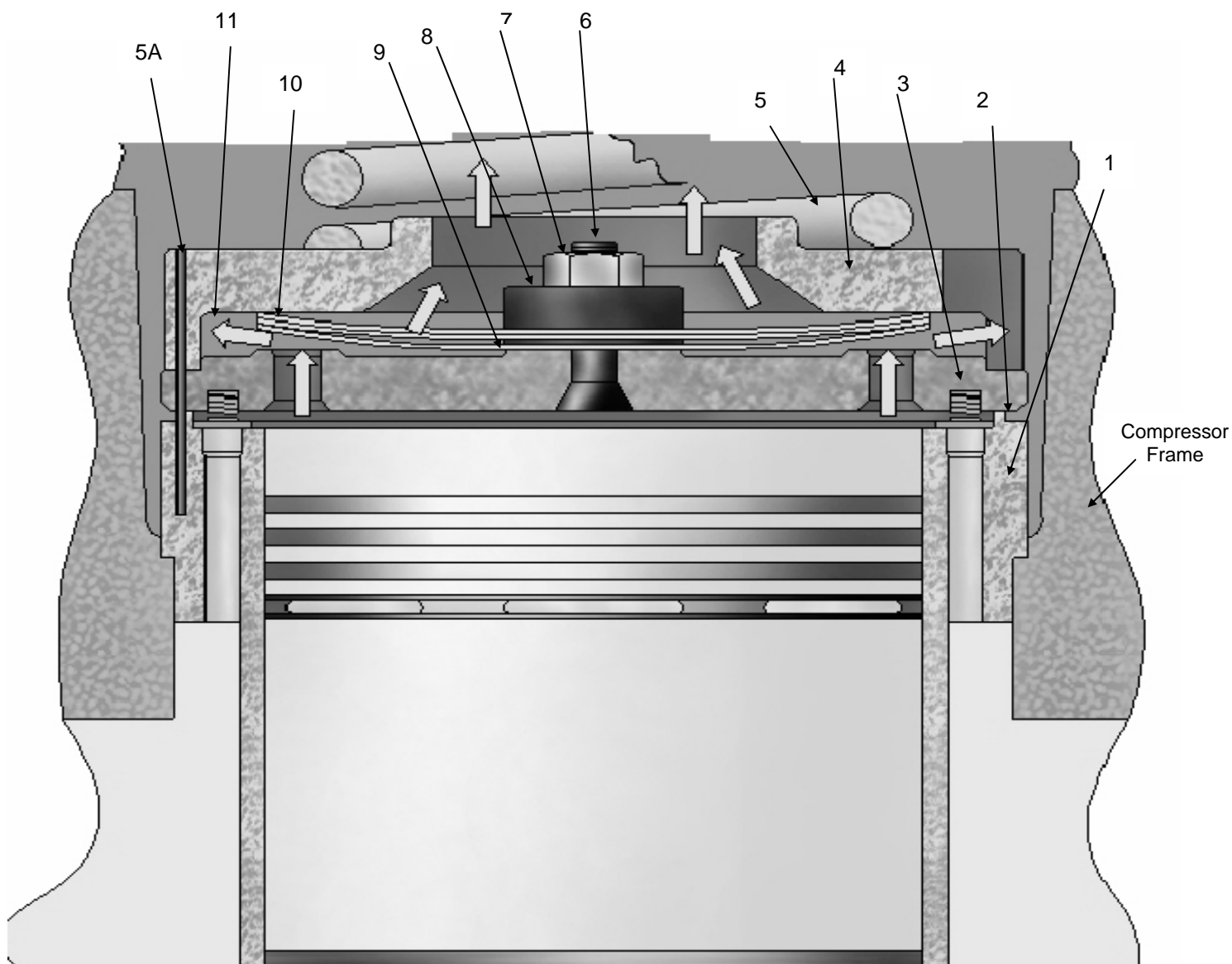
Ensure the valve plate rotates freely, without binding. Replace the safety head assembly in the frame. Be sure no debris or foreign material is on any parts. Replace safety yoke on top of the safety head assembly.

B. Reassembly

1. 440 Compressor (Mushroom Style)

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor



KEY			
ITEM NO.	ITEM NAME	ITEM NO.	ITEM NAME
1	Cylinder Liner	6 *	Valve Retaining Screw
2	Suction Valve Plate	7 *	Hexagon Lock Nut
3	Suction Valve Spring (4)	8 *	Valve Washer
4	Safety Head Yoke	9 *	Valve Spacer
5	Safety Head Spring (4)	10 *	Diaphragm Discharge Valves (3)
5A	Roll Pin (4)	11 *	Safety Head

FIGURE 2. UPPER CYLINDER CROSS SECTION

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VILTER MultiCylinder Compressor

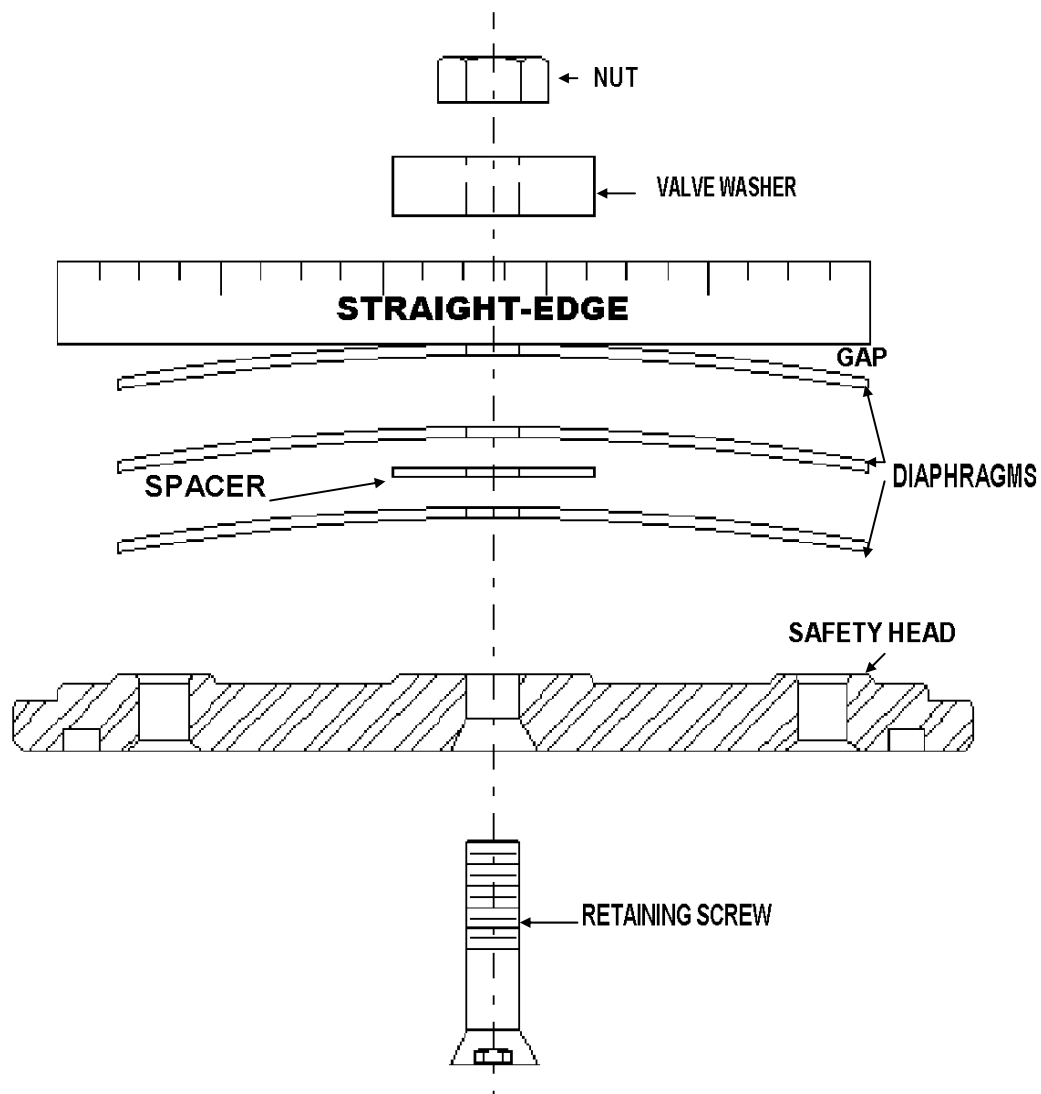


FIGURE 3. DISCHARGE DIAPHRAGM VALVE PLACEMENT

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

1. 440 Compressor (Mushroom Style) (cont'd)

All replacement parts are drilled. They are interchangeable with original parts. All replacement cylinder line kits have roll pins. Discard roll pins if new liner is being used with old safety head and safety head yoke. The old style frames have built-in guide lugs which serve the same purpose as the roll pins. Replace safety springs and cylinder covers on the compressor.

NOTE:

Compressors with serial numbers 7000 and higher have 4 holes drilled through the safety head and safety head yoke into the cylinder liner, to accommodate roll pins.

After replacing the cylinder cover, return the unloader mechanism to its operating position by removing the metal rod from the hole in the frame. This allows the piston to rise. Put the plug back into the hole (hole 'B') in the frame and reconnect the unloader lines.

2. 450, 450XL Compressor (Bullet Style)

Before assembling the valves, safety head and yoke, use a solvent to remove any dye, paint or tape you may have used as a marker.

Put the suction valve into their holes with the end that has two coils closely wound towards the bottom of the hole and twist with the top of the finger. This will lock the spring in its hole. The springs are properly installed when the safety head can be inverted without the springs falling out. Springs of all the same "hand" are used (wound the same way). This allows the valve to rotate during operation. When the valve rotates, the action tends to "heal" any small nicks or scratches on the valve or seal, and clean away any foreign material or dirt which may lodge between the valve and seat. This will also spread out the plate wear from the springs.

Place the suction valve into its cavity in the cylinder liner with the "top" facing up. The valve plate should rotate freely without binding. Replace the safety head assembly in the frame.

IV. COMPRESSOR DRIVE TYPES

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

A. V-Belt Drive Compressors

1. Belt Removal

Remove belt guard.

Loosen motor rail clamps. Remove tension on belts to provide enough slack to allow the belts to be removed from the drive without having to pry or roll the belts off.

If belts are to be reused, mark the belts to orientation on the drive. The belts can now be removed.

2. Flywheel Removal

Remove flywheel screw holding the flywheel on the shaft.

Install flywheel puller on the flywheel. An alternate tool can be fabricated from a 4½" (107.95 mm) diameter steel plate, ½" (12.7 mm) thick with three equally spaced 11/16" (17.46 mm) holes on a 3½" (82.55 mm) or 37/8" (98.43 mm) bolt circuit. See Figure 4. Also needed are several 1¾" (44.45 mm) plate washers and three 5/8" (15.88 mm) x 1¾" (44.45 mm) long screws. Place several washers against the end of the shaft so they extend past the flywheel hub.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

2. Flywheel Removal (cont'd)

Screw the plate to the flywheel and tighten the screws so the plate pulls tight against the washers. Tighten the screws evenly so they pull the flywheel. Apply pressure until the flywheel breaks free.

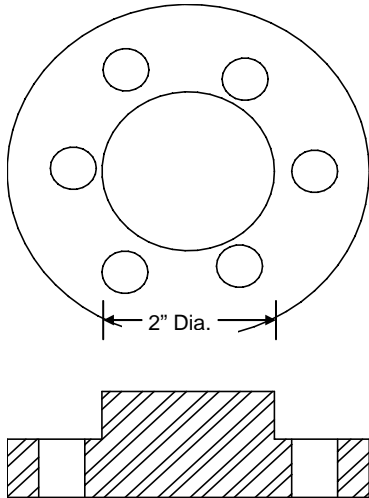


FIGURE 4. FLYWHEEL REMOVAL TOOL

3. Sheave Removal

Specific instructions for motor sheave maintenance are located after the Operation Section of this manual. These should be consulted for specific maintenance instructions.

4. Drive Inspection

Inspect the motor and compressor shafts, sheave bushing and flywheel for fretting corrosion or other wear. Fretting corrosion is the result of ^{5" Dia.} ~~the result of t~~ ~~ilic surfaces~~ (a shaft and flywheel or bushing bore) having movement relative to one another. This is usually due to the incorrect tightening of drive components, use of oil or other anti-seize compounds, worn components, burrs or other imperfections not allowing the flywheel and crankshaft to mate properly.

Signs of fretting corrosion are reddish brown powdery oxidation and wearing away of the surface of the shafts or drive component shaft bores. Minor fretting corrosion may be eliminated through light sanding after which the adequate contact area between the crankshaft and flywheel must be assured to prevent further fretting. Heavy fretting corrosion will require repair or replacement of the motor shaft or replacement of the compressor crankshaft and drive components. The flywheel or crankshaft should not be re-matched to eliminate the results of the fretting corrosion, as adequate clearances cannot be assured after remachining.

The drive keys should fit tightly in their respective grooves and be free of damage. The keyways should also be free of chips and burrs that would not allow full contact of the key to the keyway.

The flywheel and sheave should be inspected for abnormal wear and damage. A groove wear gauge should be used to check condition of the sidewalls and width of the groove. Excessive wear is not permitted as this will lead to problems in achieving correct belt tension and loading, contributing to excessive belt and sheave wear.

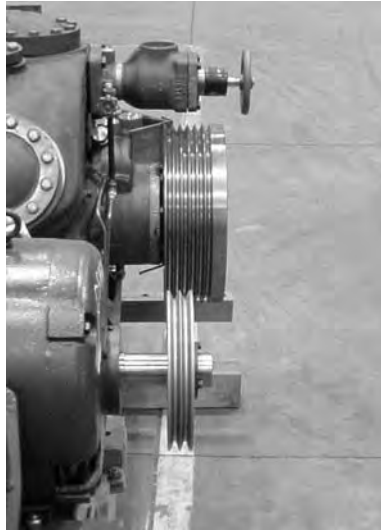
Clean any foreign matter that has accumulated in the grooves.

The sheave and pulley should be inspected for cracks and other damage that could affect the integrity of the drive components.

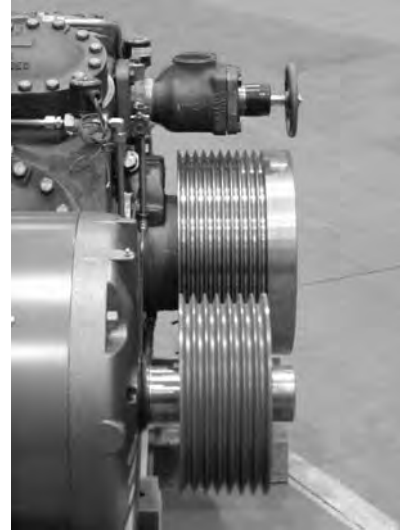
The sheave and pulley should be inspected for excessive run-out, indicating bent components. Bent pulleys or sheaves will wear the groove sidewalls unevenly, as the belt changes its angle of engagement as the pulley turns.

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456XL Booster



458XL High Stage

FIGURE 5. UNIT BELTING REQUIREMENTS DUE TO HORSEPOWER

4. Drive Inspection (cont'd)

The groove bottom should also be checked for polishing, as this indicates the belt is not riding correctly in the groove. What has happened is the belt or groove has worn to the point the belt is actually rubbing on the bottom of the groove. This effectively changes the pitch diameter of the sheave or pulley for that groove, causing the belt to operate at a different speed than the rest. This will result in excessive heat and wear to the drive components.

When drive components are replaced, it is necessary to replace them with identical components. Due to operating conditions and the horsepower requirements of the compressors, the number of belts on a compressor package can vary from 2 through 10 belts and not all flywheel grooves will be filled.

Drive belts should be inspected for abrasion, tearing, separation or checking that would indicate possible damage to drive components or alignment problems. They should

also be inspected for sharp bends and kinks while they are slack as this indicates internal damage due to incorrect installation techniques. The belts can be cleaned at this time. **Only soap and water** should be used to clean the belts and other components. Belt dressing should never be used on drive components, as it will attack the elastomer used in construction of the belts.

Belts should always be changed in sets to minimize length variations between used and new belts. Note the match numbers on the belts. The same number must be on all belts in the set.

5. Drive Installation

If installation is new and the belts are being installed for the first time, the following items must be taken care of before the belts can be installed.

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5. Drive Installation (cont'd)

The compressor, motor and base should be level. This will help speed the alignment process of the unit if the shafts are level and in the same plane before starting the alignment process.

All piping must be finished and properly supported. Any piping stress must not be permitted to act on the compressor frame. The base must be secured to the floor and grouted.

The compressor should be checked for a soft foot and shimmed accordingly. Elimination of a soft foot in a belt drive compressor is essential to reduce vibration and misalignment problems.

The sheave and pulley should be checked for paint and foreign matter in the grooves. Any foreign material will cause a decrease in the horsepower transmitting ability of the belts and lead to accelerated wear of the belts, pulley and sheave.

If this is an existing installation, the motor and compressor shafts should be checked to see if they are level and in the same plane before starting the alignment process. If the compressor has been moved or if there is a complaint of excessive vibration, the compressor should be checked for a soft foot.

Absolutely no lubricants or anti-seize compounds should be used in the installation of the motor sheave and bushing, or the crankshaft and flywheel. The bushing as supplied by the manufacturer should not have any lubricant applied to it or the sheave bore. The applied lubricant will be trapped between mating surfaces of the sheave and bushing, or bushing and shaft. When the components are tightened, the resulting hydraulic pressure of the lubricant trapped between the mating surfaces will result in a cracked sheave or bushing. Lubricant or anti-seize is usually applied to the shaft for ease of dis-

assembly. As the anti-seize is trapped when the parts are tightened, it will create a sliding layer between the parts. The parts are not free to move independent of each other while the unit is in operation, creating fretting corrosion. This results in excessive wear of the drive components and the possibility of the parts welding themselves together.

The belts can now be installed. The motor should be moved towards the compressor to facilitate the installation of the belts.

The belt closest to the compressor should be installed first. The belts should not be rolled or pried when installing them, as this will damage the cords in the belts and cause a failure in a short time.

6. Drive Alignment

There are 3 different types of misalignment that are possible, more than one of which may be present at any one time. These are:

- Horizontal angular
- Vertical angular
- Parallel

Although V-belt drives are somewhat tolerant to misalignment, the maximum amount of misalignment permitted is $\frac{1}{16}$ of an inch per 12" of shaft, center to center distance. If this is exceeded, excessive drive, belt and bearing wear will result.

Horizontal angular misalignment results when the motor and compressor shafts are in the same horizontal plane, but not in the same vertical plane. A straight edge is held against the compressor pulley face. The distance from the straight edge to the motor sheave sides is compared. They should be the same. If they are not the same, adjust the motor to bring the sheave and pulley into alignment.

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6. Drive Alignment (cont'd)

Vertical angular misalignment results when the motor and compressor shafts are in the same vertical plane, but not in the same horizontal plane. A straight edge is held against the compressor pulley face. The distance from the straight edge to the motor sheave at the top and bottom is compared. They should be the same. If the back of the motor is sitting low, the top of the sheave will be back further than the bottom of the sheave. The motor must be shimmed so the top and bottom of the sheave are in the same plane as the compressor pulley.

The last check is the parallel alignment. This check aligns the belt grooves of the pulley and sheave. The measurement is taken from a straight edge held at the outer rim to the edge of the first groove used on the compressor pulley (usually not all grooves are filled due to horsepower requirements). This is then compared to a measurement taken from the straight edge to the corresponding groove on the sheave. The sheave position is then adjusted to assure the sheave is in line with the flywheel.

7. Belt Tension

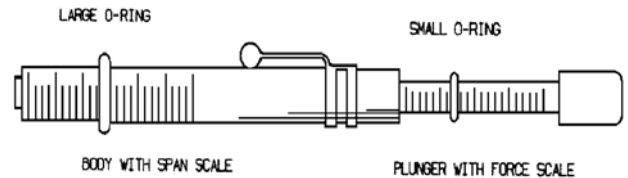
Proper tension is essential to long belt life. An improperly tensioned belt will result in inefficient operation and excessive heat. The ideal tension is the least amount of tension at which the belt will not slip under the load.

8. Single 5V, V-belts

One device that provides the most accurate way of measuring the tension of the drive belts is a belt tension spring scale (Vilter Part No. 3072A). See Figure 6. This device measures the amount of force needed to deflect the belt a given amount. The range of the readings should be between 12 to 18 lbs. The deflection should be $\frac{1}{64}$ " per inch of span. If the span of the belts from the sheave to the flywheel is 38 inches, the

amount of deflection should be $\frac{19}{64}$ " (7.54 mm) and the tension required to achieve it should be between 12 to 18 lbs.

FIGURE 6. BELT TENSION SPRING SCALE



The belt tension spring scale is placed in the center of the belt span. The scale is then pushed down until the proper deflection is reached. The tension should then be read and recorded. The process is then repeated for the remaining belts.

If the tension is too low, the belts should be tightened evenly and rechecked.

The tension between belts should be within ± 1 lbs. of each other. Inconsistent measurements indicate problems with alignment, belt length and/or wear of the drive components. The problem should be corrected before the unit is returned to service.

9. Banded 5V, V-belts

Due to their design, banded V-belts require special tensioning techniques in order to set the tension properly. There are two methods to check the tension of banded belts. They are as follows:

The first method utilizes a tension tester to measure the deflection. The number of belt bands in the belt is multiplied by the deflection force of 12 to 18 lbs. A board or metal plate is then placed across the bands to equalize the force as the tension tester is depressed on the board or plate.

9. Banded 5V, V-belts (cont'd)

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VILTER MultiCylinder Compressor

A straight edge is positioned across the sheave and flywheel to use as a reference to measure the deflection of the belts.

The second method measures the amount of stretch as the belts are tightened to determine the tension of the belts. The banded belts are installed on the drive and rotated to get all the slack on the bottom side. The belts are then tightened to remove the slack from the belts. Measure the outside circumference to the nearest $\frac{1}{4}$ " (6.35 mm). Multiply this reading by $\frac{3}{4}\%$ (0.0075) to 1% (0.01). Add this to the circumference reading. Elongate the belt to the new length.

EXAMPLE: $80" \times 1\% = 0.8" + 80" = 80.8"$

B. Direct Drive Compressors

1. Coupling Removal

Remove the guard. Remove the bolts that extend through the coupling and remove the center member. Remove the bolts that hold the shim packs to coupling, and make note of location of the washers. Using one or two of these bolts through the shim pack will keep the shims in alignment.

To remove the coupling from the crankshaft, remove the screw (and washer, if present). Try to lightly tap the coupling off the shaft, or apply heat to coupling. A puller can be constructed out of a flat steel bar with holes that match two holes in the coupling in a straight line past the center of the crankshaft. Make a hole in the center of the bar for a $\frac{5}{8}$ " (15.88 mm) bolt, thread the hole or weld a $\frac{5}{8}$ " (15.88 mm) nut inline with the hole. Bolt this bar loosely to holes in coupling. Place a solid washer or disc (a little smaller than end of the shaft) between the bar and in front of the tapped hole in the crankshaft. Using a $\frac{5}{8}$ " (15.88 mm) bolt, apply force to center crankshaft and a pulling force on the coupling.

2. Coupling Replacement

Inspect the compressor coupling bore and crankshaft to make sure they are clean and free of burrs. Apply anti-seize to shaft and coupling bore. Place the key on the shaft and slip on the coupling. Install the bolt (and washer, if required), and tighten.

Reassemble shim pack and center member in correct orientation. Tighten bolts and note distance between hubs per coupling manufacturer's bulletin. This bulletin is located in the Installation Section.

Recheck alignment, if necessary.

V. CAPACITY CONTROL

A. Old Style (Mushroom Type)

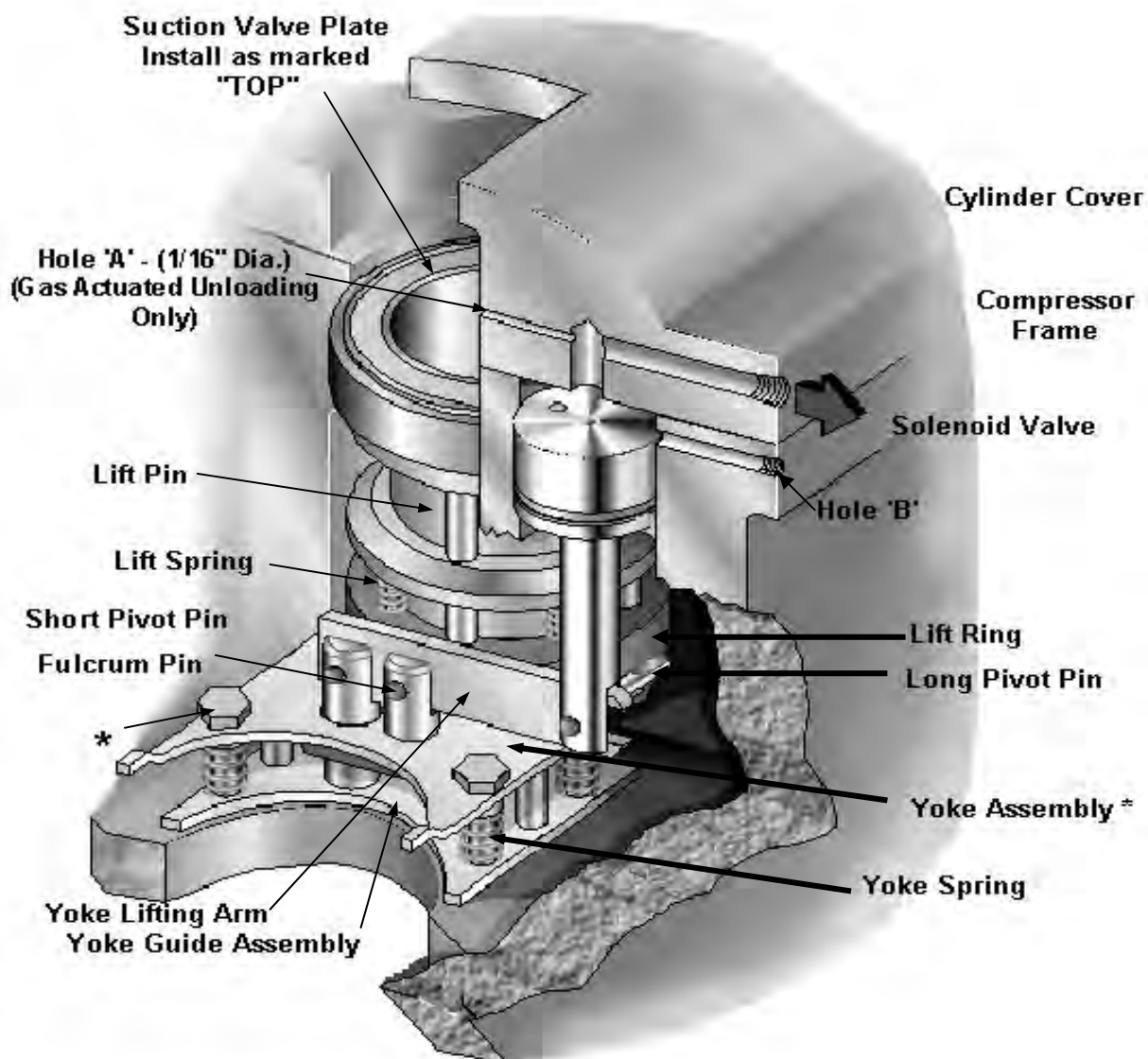
1. Lift Pins, Ring and Springs Removal

The valve lifting mechanism consists of the lift pins, lift ring and lift springs all assembled to the cylinder liner. To remove these parts from the cylinder liner, place the liner on a flat surface in an upright position. Rotate the lift ring slightly until the four semi-circular notches line up with the lift pins, and slide the ring down off the liner. Lift the pins out of the top of the liner.

In order to put the unloading mechanism onto the cylinder liner, set the lift ring on a flat surface with the guides for the lift springs facing up. Next place the cylinder liner inside the lift ring. Drop the four lift pins into their holes in the liner with the notched ends of the pins facing down and the flat side facing out. Lift the rings so the semicircular notches slide over the pins. Then, rotate the lift ring so the springs fit into their holes in the cylinder liner.

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Use this illustration for:

Oil Actuated Unloading

- High Stage
- Booster
- Both Stages of 2-Stage

Gas Actuated Unloading

- High Stage
- High Stage of 2-Stage

* Yoke assembly is bolted down on one end as shown on the two cylinder and two-stage compressor capacity control mechanism. All other compressors do not use these bolts.

FIGURE 7. TYPICAL CAPACITY CONTROL MECHANISM ARRANGEMENT – 440 COMPRESSOR (OLD STYLE MUSHROOM TYPE)

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VILTER MultiCylinder Compressor

2. Actuator Mechanism Removal

The first step of removing capacity control actuator from the machine is to push the unloader piston down with a block of wood. This holds the assembly depressed and makes handling much easier.

Push the assembly away from the unloader piston until the notch in the yoke lifting arm slides free of the flats on the long pivot pin. Then, remove the mechanism through the liner hole in the top of the frame. Remove the long pivot pin from the shaft of the piston. Now slide the piston out of the cylinder and slip the ring or rings off the piston, taking care not to break any.

NOTE:

Gas actuated unloader pistons have two grooves and use four metal piston pins. Oil actuated unloader pistons have one groove and use a rubber piston ring (o-ring).

3. Actuator Mechanism Replacement

Gas actuated unloader piston:

Clean the piston thoroughly and place four steel rings in each groove. Work the rings in carefully. Avoid breaking them. Place the piston in the cylinder and compress the rings to work them into the cylinder.

Oil actuated unloader piston:

Clean the piston thoroughly and place the o-ring on it. Work the o-ring on carefully to avoid breaking or excessively stretching it. Liberally coat piston and o-ring, as well as cylinder bore, with compressor oil. Place the piston in the cylinder and compress the o-ring to work it into the cylinder.

Next, insert the long pivot pin into its hole in the piston shaft and position it so the flats will receive the slot of the yoke lifting arm. The end of the pin is machined flat so the installer can see the position of the inner flat. Compress the yoke assembly and place a piece of $\frac{5}{16}$ " (23.81 mm) o.d. steel rod under

the rear of the lifting rod. This keeps the yoke depressed for easier handling. Place the yoke into the frame through the cylinder opening and position it so the slot on the yoke lifting arm registers with the flats on the long pivot pin. Depress the piston with a block of wood, and remove the rod or piece of wood used to hold the yoke assembly depressed. Then, center the assembly between the two cylinder liner holes.

B. New Style (Bullet Type)

1. Lift Pins, Ring and Springs Removal

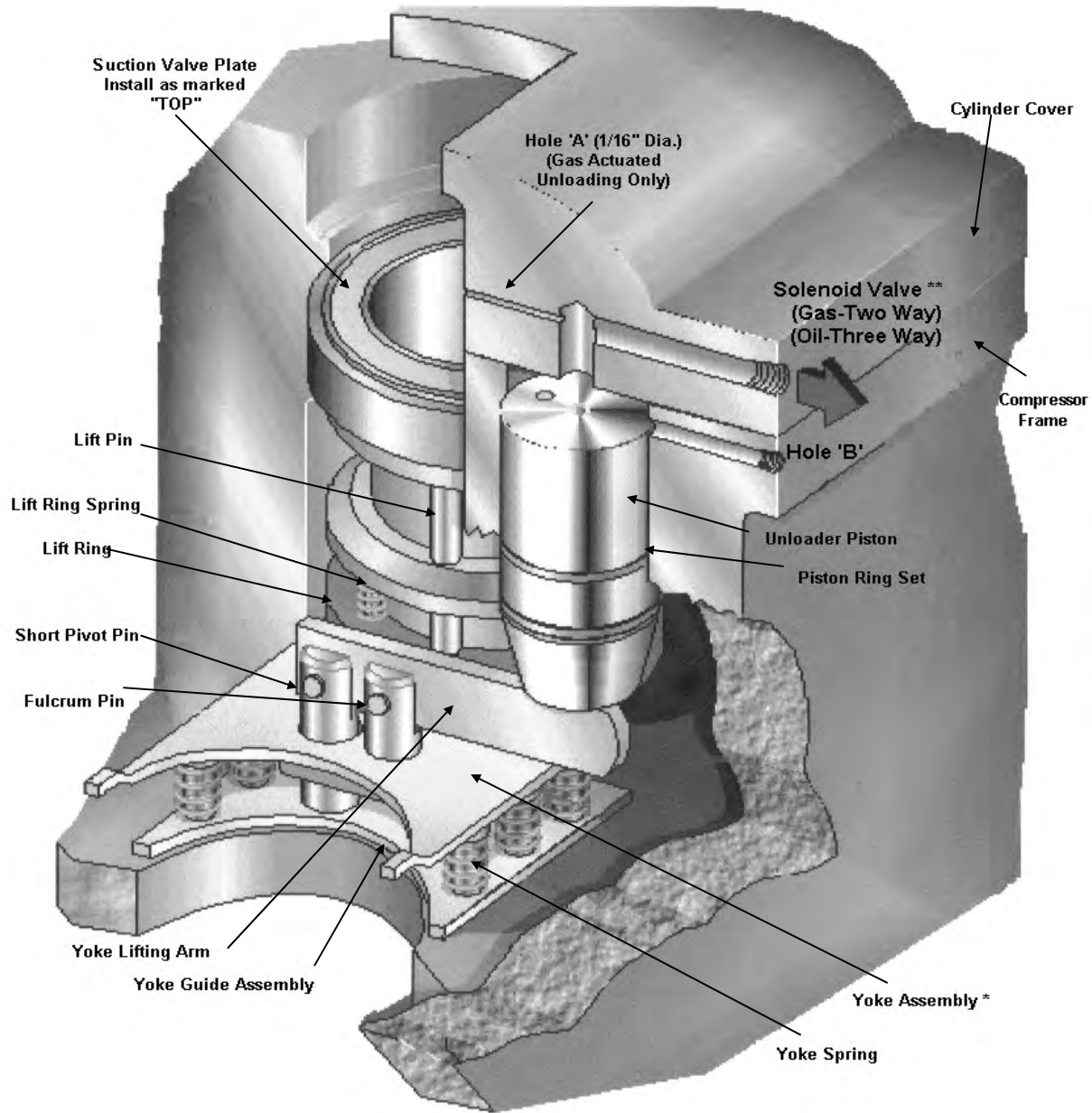
In order to put the unloading mechanism back in the cylinder liner, place the lift pins with the springs around them in their holes. Place the lift ring on the pins with the smaller inside diameter facing top of the liner so it will slip over and cover the retainer when it is in place. Placing the liner on its side and holding the lift ring back against the pins and springs, slide the ring retainer over the liner into its groove.

2. Unloader Piston Removal

It is not necessary to remove or disturb the actuator mechanism or the cylinder liners to remove the unloader piston. There are two holes in the top of the unloader piston. One is threaded, the other is not. Use $\frac{1}{4}$ "-20NC eyebolt in the center hole. Use the other hole to keep the piston from turning in the hole in the frame while doing this. Using the eyebolt as a handle, pull the piston out of its hole in the frame.

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VILTER MultiCylinder Compressor



** COMPRESSOR APPLICATION NOTE

Gas Actuated Unloading is standard on:

- High Stage, except 100% internal CR
- Oil Actuated Unloading is standard on:
- High Stage with 100% internal CR
- Booster
- Both Stages of integral 2-Stage

**

Yoke assembly is bolted down on one end, as shown, on all compressor banks equipped with optional single cylinder unloading. All other compressors do not use these bolts.

**FIGURE 8. TYPICAL CAPACITY CONTROL MECHANISM ARRANGEMENT –
450 & 450XL COMPRESSORS (NEW STYLE BULLET TYPE)**

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VILTER MultiCylinder Compressor

3. Unloader Piston Replacement

Before reinstalling piston, remove old ring set. Clean and inspect for wear. Replace piston if wear is excessive. A ring set consisting of "PTFE" outer ring and a silicone rubber inner ring is used on the piston. Replace ring set carefully with a new one every time a piston is removed. With eyebolt removed, place the piston into its hole in the frame. Compress the rings with the fingers and work them into the hole carefully so they are not nicked or cut as the piston is moved down. Push the piston down until it touches the yoke lifting arm.

4. Actuator Mechanism Removal

Before a capacity control actuator mechanism can be removed from the compressor, at least one of its corresponding cylinder liners must be removed. The first step in removing capacity control actuator from the machine is to push the unloader piston down with a block of wood. Then take a piece of steel ($\frac{5}{16}$ " in diameter) or a piece of wood, and insert it between the two vertical rods on the yoke assembly accommodating the short pivot pin and fulcrum pin. This will hold the assembly depressed and make handling much easier. Then remove the unloader piston as detailed above. The mechanism can then be removed through the cylinder liner hole in the frame.

5. Actuator Mechanism Replacement

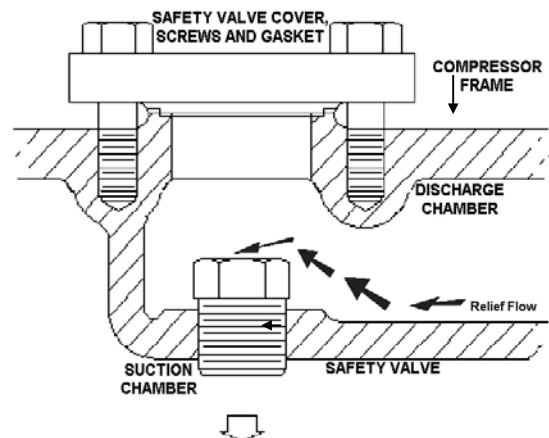
Compress the yoke assembly and place a small piece of wood or a $\frac{5}{16}$ " (7.94 mm) o.d. steel rod between the two vertical rods mentioned in paragraph 4. This keeps the yoke depressed for easier handling. Then place the mechanism into the frame through the cylinder liner opening and position it. Install unloader piston as detailed above. Depress the unloader piston with a block of wood and remove the rod or piece of wood used to hold the yoke assembly depressed. Then

center the mechanism between the two cylinder liner holes.

VI. SAFETY VALVE (INTERNAL RELIEF)

A. Removal

If, for any reason, the safety valve has relieved, install a new valve. Make no attempt to adjust the relief valve. To replace the safety valve, remove the cover on the top of the compressor frame marked "safety valve" by taking out the two screws which hold it in place. Then, remove the safety valve by using a standard $1\frac{3}{4}$ " (44.45 mm) socket.



Note: Safety Valve is set at a differential pressure of 300 PSIG (2069 kPa). Maximum discharge temperature is 300°F (150°C).

FIGURE 9. SAFETY VALVE LOCATION

B. Replacement

Lightly oil the threads of the valve and screw the valve into place. Lightly oil a new gasket and place it on the frame. Position the cover and tighten it down.

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VILTER MultiCylinder Compressor

VII. OIL PRESSURE ADJUSTMENT ASSEMBLY

A. Disassembly

The oil pressure adjustment assembly is located in the front bearing housing. It consists of a spring loaded ball positioned in a machined seat in the top of the front bearing housing. An adjusting screw turned in and out changes the amount of oil bypass, thus changing the oil pressure.

Remove the cap. A packing tool is required to remove the gland nut (Vilter Part No. A33781A). After the gland nut has been removed, use a large screwdriver to turn the stem counterclockwise and remove it completely. The packing with 2 washers should also come out. Using a pencil magnet, pull out the spring and steel ball.

B. Reassembly

Clean the steel ball and place in the hole. Place the stainless steel spring on top of it. Screw the adjustment stem in the hole to get threads started. Place a washer over the end, then packing, then the other washer. The adjustment stem may have to be turned in so the packing nut can be installed and tightened. Adjustments of the oil pressure will have to be reset after start up. Replace the cap and gasket afterwards.

C. Adjustment

To provide quick response of the compressor unloader mechanism, it is recommended the oil pressure relief valve be set to maintain 40 psi (275.79 kPa) net oil pressure. Net oil pressure should be held at 35 psi (241.32 kPa) and 40 psi (275.79 kPa). Net oil pressure is calculated by subtracting the compressor suction pressure from the oil pressure gauge reading while the compressor is running.

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

A. Removal

To remove the oil filter, drain the tank by removing the pipe plug on the bottom or side. Next remove one of the front screws. It can then be threaded back in at least 2 turns, or a 1/4" (6.35 mm) longer screw can be used and also threaded in 2 turns. This will be the pivot point or hinge to swing the filter and tank out for ease of removal. By unscrewing the remaining 3 screws alternately, the tank will start to lower until the first screw installed comes in contact with the filter adapter. Force the center tube top plate down and out of its connection hole while pivoting the filter tank. Now that the filter and center tube can be removed, disassemble the center tube by removing the bottom spring plate. Slide the old filter off and discard properly. The tube should be washed off and clean.

B. Replacement

Make sure to remove the used gasket of the filter adapter and install a new one. After cleaning the tank, reinstall the pipe plug in the drain. Install it on its pivot screw. Add fresh oil to fill half the tank. Reassemble the new filter on the center tube. Slowly place the filter in the tank and allow the filter to absorb the new oil. Pivot the tank under the adapter and align the center tube in its hole. Start the remaining 3 screws then tighten the tank flange to the adapter. The proper placement of the mechanism, once in the frame, is having the curved sides of the bottom plate on the mechanism aligned between the lower liner bores.

VIII. TRI-MICRO OIL FILTER

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VILTER MultiCylinder Compressor

IX. OIL PUMP ASSEMBLY

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

A. Removal

To remove the oil pump assembly, first remove the filter tank and adapter from the rear housing. Be prepared for a small amount of oil to drain from adapter. The pump will be exposed in the center and the outer pump housing will be covered by a gasket. Remove gasket. At the top right and bottom left, you will find tapped holes to aid in removing the pump, if necessary. The pump housing is approximately 1½" (38.1 mm) thick, so it requires jack screws 2" (50.8 mm) or longer to release the inner gasket. Once loose, pull the oil pump straight back.

The oil pump is a factory built and tested component. It is furnished as a complete assembly only and cannot be serviced in the field.

B. Replacement

To replace the oil pump assembly, first rotate the crankshaft so the drive key is hanging from one of four screws through the rear bearing retainer. Make sure the small orifice plug in the rear housing (at the 12 o'clock position) is clear. Clean all gasket surfaces. Install gasket (Vilter Part No. 31899A), correctly aligning oil passage holes. Align pump shaft flats to match flats in pump drive key. The locating dowel pin in the rear housing should align with hole in the pump housing to the top-left-center.

Install the pump and seat it against the inner gasket. The outer surface of the pump should now be recessed approximately 1/8" (3.175 mm) to the rear bearing housing. Install gasket (Vilter Part No. 31900A), correctly aligning the holes. The slot in this gasket should be at the 9 o'clock position. Place the rubber seal gasket on the filter adapter, and reattach the filter assembly onto the rear housing. Install screws and tighten down evenly.

X. PREPARATION FOR INTERNAL SERVICING

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

A. Handhole Cover Removal

To work internally on the compressor, the handhole cover and crankcase oil will have to be removed to gain access. The heater will have to be electrically disconnected at this time. Remember to shut the power off and lock it out. After disconnecting the wiring, loosen all but two screws on the upper corners of the cover. This helps support the cover during removal and prevents damaging the heater. If the cover sticks to the frame, a slight tap with a lead or soft face hammer will free it.

Holding the cover in place, remove the two remaining screws, and pull the cover straight back away from the frame. Remove any gasket material from the cover and frame face. Also inspect and remove any burrs or rough edges from the mating surfaces to ensure a tight seal at time of reassembly.

B. Handhole Cover Replacement

Lightly lubricate both sides of a new gasket with refrigerant oil or general purpose grease. Place the gasket on the cover, and guiding in the heater, place the cover against the frame opening. While holding the cover and making sure the gasket is still in place, insert two screws in the lower row to help support the cover and keep the gasket from slipping out. Start the rest of the screws in their holes and continue to check gasket placement. Tighten screws evenly to the torque requirements in Table 2, 3 or 4 (depending upon compressor model). Connect the

B. Handhole Cover Replacement (cont'd)

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

heater wiring and heater cover, add oil to crankcase and turn on power to the heater to preheat the oil for operation of compressor.

XI. CRANKSHAFT SEAL

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

A. Oil Seal Leakage

In refrigeration compressors, a slight amount of oil leakage past the crankshaft seal is normal and desirable. A few drops per minute is reasonable. This leakage performs two important functions. It helps lubricate the neoprene bellows and o-rings, and it helps cool mating rotating parts to provide less wear and longer life. A receptacle for collection is recommended.

B. Removal

The flywheel or coupling will have to be removed. Detach the tubing line on the bottom of the front housing. Oil will drain from the seal chamber, be prepared to collect it. After the oil has drained, remove the 8 screws holding the cover. When removing the cover, caution should be taken because the front carbon seal might come off with the cover. At this time, if the seal is going to be reused, clean the surface of the shaft and avoid getting anything in the housing area.

Grab the front rubber bellows and pull forward. It should release. If not, pry by the tabs on the metal ring (alternating force from side to side) to remove it. Remove the large spring.

Next step is to remove the 3 screws in the retainer that hold the inner mirror seat. Put 2 of these screws in the tapped holes of the retainer. Rotate the retainer so screws are at 3 and 9 o'clock positions. Pull on the screws to aid in removing the retainer and the rest of the seal assembly. Clean out the seal chamber with suitable refrigeration parts cleaner. Afterwards, coat the area and crankshaft to keep them from rusting.

C. Installing A New Shaft Seal

Remove the mirror seats from the inner retainer and outer cover. The mirror face can be removed by tapping on back side that is exposed in each part. Make sure these parts are then cleaned. Place either on a flat surface with the recess up. Oil the o-ring sealing area. Take the mirror face (do not touch the mirrored surface), oil outer o-ring and lay it in the cover or retainer with the mirror face upward. Using a very clean cloth or similar item, cover mirror face and, using palm of hand, set it in the recess. Repeat this assembly process for the other mirror face.

Vilter recommends that if any part of a seal needs replacement, the entire shaft seal should be replaced with a new one.

Make sure the oil passage in the shaft is unobstructed. Install the inner retainer with mirror face, flush in front housing, with the word "TOP" at the top. Tighten down evenly with the 3 screws.

The shaft seal assembly is symmetrical. It can be installed in either direction. Spray oil on inner mirror face. Liberally coat oil on one of the bellows and carbon assemblies. Avoid coming in contact with carbon. Carefully slip the assembly on the shaft until the carbon touches the mirror face. Put the spring over the shaft and seal on the bellows assembly, and slide it onto the shaft to join up with the spring. With the new cover gasket in place, install the cover over the end of the shaft.

Push the cover all the way on, lining up the bolt holes so the drain is to the bottom. Tighten down the 8 screws evenly to the torque requirements in Table 2, 3 or 4 (depending upon compressor model).

XII. CONNECTING RODS AND PISTONS

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

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VILTER MultiCylinder Compressor

A. Disassembly

After the cylinder covers, valves and handhole cover have been removed, the first step in removing the piston and rod assembly is to remove the Palnut® locknuts on the rod bearing bolts. Then, remove the plain nuts and slide the bearing cap off of the nuts. The Palnut locknut is not used with this type of locknut.

Handle the bearing cap carefully to avoid damage to the bearing half insert. Push the rod and piston out through the top of the cylinder. Avoid possible mixing with components. Keep all parts together in relation to their position in the compressor. Connecting rods and rod caps are match marked to aid in reassembly. On reassembly, all parts must be installed in the same position in the compressor.

As soon as the parts are removed from the compressor, they should be thoroughly cleaned with a suitable refrigeration parts cleaner. Once the oil film is removed, the bare metal is subject to rust. This reaction can start immediately. Therefore, lubricate the surfaces of the parts lightly with clean compressor oil immediately after cleaning.

The tabs on the bearing half insert fit into the recess in the rod and rod cap, and the inserts can be slipped out without difficulty. To replace the rod bearings, it is necessary to change the inserts only and not the entire rod.

1. 440 & 450 VMC Compressors Only

To remove the rod from the piston, take out the piston pins. Remove the spring locks from the pin hole on each side of the piston and slide out the pins. If this cannot be accomplished by hand, it may be necessary to force the pin out with a brass rod and hammer. Be careful not to damage spring lock grooves. To remove the piston rings, use the ring expander. Caution should be exercised to prevent the rings from scoring the piston.

2. 450XL VMC Compressor Only

If the piston rings are to be removed, wrap a piece of thin shim stock around the piston. Work the rings carefully out of their grooves and onto the shim stock. They can then be worked down over the piston. Caution must be exercised to prevent breaking the rings.

The piston and connecting rod assembly should not be disassembled further. It is furnished only as a complete assembly and should not be worked on in the field.

B. Reassembly

All new compressors use three compression rings and one oil control ring. When replacing rings, use the ring expander. Check the grooves to make sure they are clean.

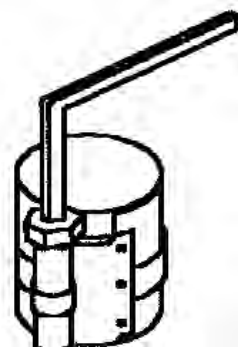


FIGURE 10. PISTON RING COMPRESSING TOOL

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B. Reassembly (cont'd)

The easiest way to replace the rings on the piston is to wrap a thin piece of shim stock around the pistons and slide the ring over this. Do not force the rings when sliding them onto the shim stock. The rings are brittle and may snap. A tool is also available to aid in the installation of the rings.

Both compression and oil rings are marked to indicate the top of the ring. Install the compression rings with the identifying mark to the top of the pistons. Rotate the end gaps on each ring so they are not aligned on the piston.

Remove the piston assembly. Check the fit of the piston pin bushing for wear. The 440 and 450 have a different pin and piston design from the 450XL compressor. The 440 and 450 piston and piston pin bushing have a "slip" fit. When replacing the piston and bushing, the bushing must be reamed to the correct "slip" fit after installation into the rod to accommodate the new piston pin. The 450XL piston and piston pin bushing cannot be changed in the field due to tolerances. They must be purchased as a unit with the connecting rod and piston assembly.

The piston pin should not slip easily into its hole, but it must not be driven down. It may be necessary, however, to tap the pin lightly with a block of wood and a hammer. Be sure the hole in the rod pin bushing is aligned so the pin can slip through it. When the pin has been tapped in far enough, install the two piston pin lock rings, one at each end of the piston pin.

Two styles of bearing half inserts have been used in the compressor. One style has only the hole in the rod half to allow oil to travel up the rod. The second type has annular grooves to allow a continuous supply of oil.

The bearing inserts should never be spread open, by hand or any other means, to provide for a tighter fit in the rod.

If an inspection indicates the rod bearing surfaces are worn, replace the bearing insert. Assemble bearing inserts by pressing them into place, making sure the notch in the rod is clear.

If the bearing insert does not properly fit in the rod and it falls out during assembly, either the bearing insert or the rod is worn or incorrectly made.

When installing the bearing insert into the connecting rod, make sure there is no oil on the connecting rod or the back side of the bearing insert.

If the original bearings have failed, check the crankshaft bearing surface. If there are slight imperfections due to bearing failure, remove by polishing with fine crocus cloth. Then, clean the bearing surface with suitable refrigeration cleaner and lubricate with clean compressor oil.

Lubricate the inside of the cylinder and the entire piston. The recommended method of installing the piston in the liner is with the use of a Piston Ring Compressor. See Figure 10.

Attach the oil line to the bottom of the front housing. Do not over tighten the nut. Rotate the shaft a few times to help the seal settle into position.



FIGURE 11. FRONT COVER ASSEMBLY AND DISASSEMBLY STUD

CAUTION

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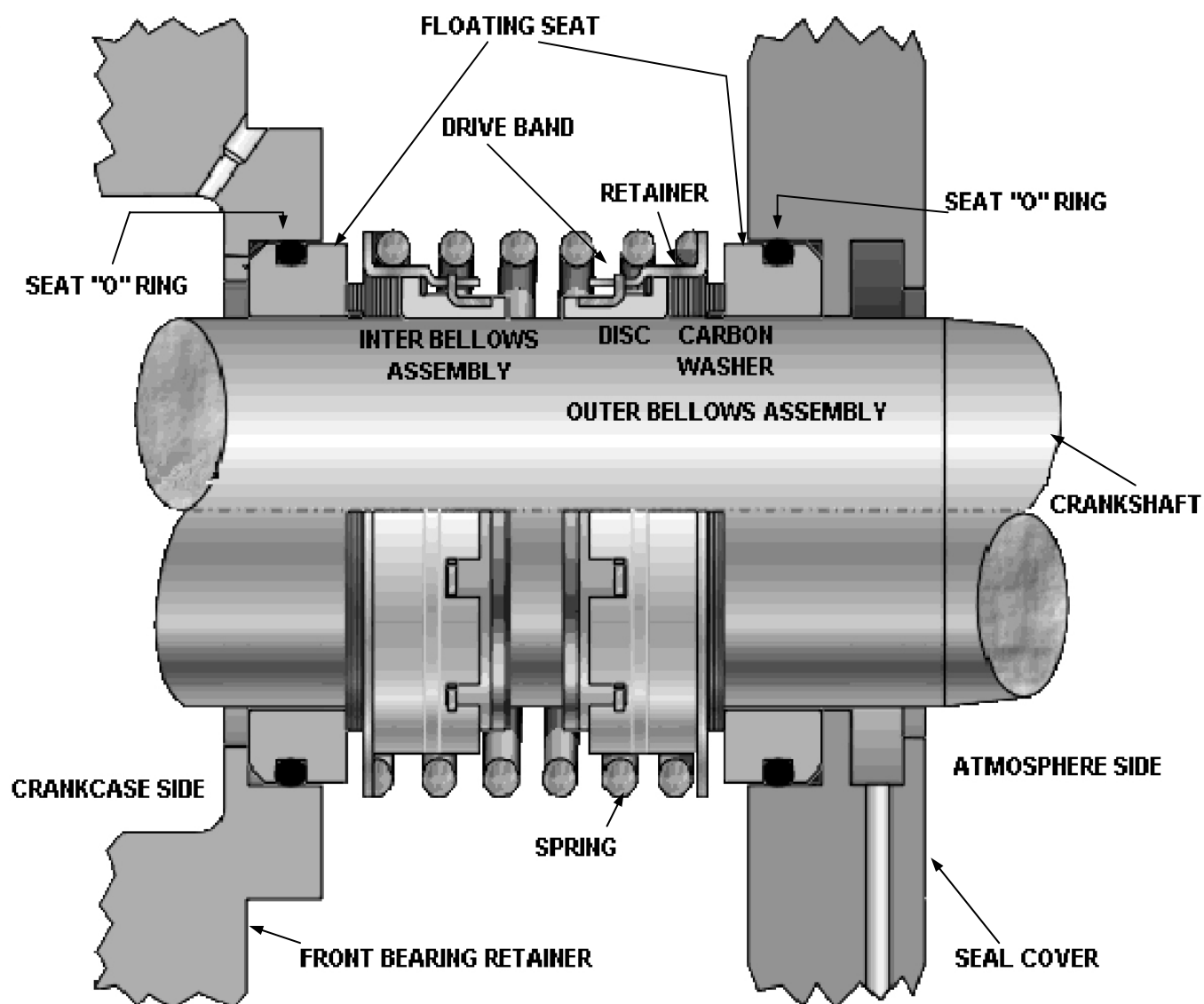


FIGURE 12. CRANKSHAFT SEAL ASSEMBLY

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B. Reassembly (cont'd)

Connecting rod bolts are secured with one plain steel nut and one spring steel locknut (commonly referred to as a "Palnut"). The plain nut tightening torque should be listed in Table 2, 3 or 4 (depending upon compressor model). The torque wrenches should be set to the high side of the tightening torque range.

As the rods, bearing inserts and crank pins are all machine to fine tolerances, no further adjustments are necessary.

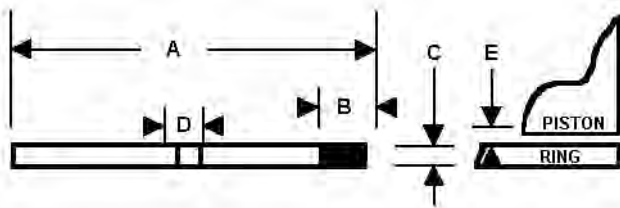


FIGURE 13. PISTON RING DIMENSIONS

TABLE 1. PISTON RING DIMENSIONS AND TOLERANCES

DIMENSION	COMPRESSION RING	OIL RING
A	4.500	4.500
B	0.160 to 0.170	0.170 to 0.180
C	0.1230 to 0.1240	0.1860 to 0.1870
D	0.013 to 0.0225	0.013 to 0.023
E	0.002 to 0.004	0.0015 to 0.004

After a plain nut has been placed on a rod bolt and torqued to the specified value, turn a Palnut to the rod bolt with the open end of the hexagon pointing away from the plain nut. The Palnut should be turned until mating parts are pulled together and actual tightening begins.

Final tightening and locking is then achieved by giving the Palnut an additional 1/3 to 1/2 (maximum) turn. Although the plain steel nuts may be reused, new unused Palnuts must be used each time the connecting rods are reassembled to the crankshaft. If used Palnuts are installed, their

locking feature is lost and a loose rod connection may result. After each rod is installed, rotate the crankshaft by hand to make sure everything is free and there is no binding of the rotating parts.

CAUTION

Late model VMC compressors may push liners out.

XIII. CYLINDER LINERS

NOTE:

Before proceeding, refer to Paragraph I, "General Service Instructions".

A. Removal

Once the piston and rod assemblies are removed, the liner can be extracted from the frame by means of a Vilter Liner Pulling Tool (KT 257). This tool, or similar, is required for all 440/450 compressors and 2-stage compressors.

NOTE:

If the cylinder bank has unloading, the unloader piston needs to be held down for ease in liner removal.

The liners in the 450XL compressor have a looser fit into the frame. They can be removed by pulling from the bottom of the liner by hand.

NOTE:

2-Stage liners have an extra groove without ring that seals the suction chamber from the crankcase.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

B. Lift Rings For Unloading

There are two styles of unloading lift ring assemblies.

1. 440 Lift Ring Assembly

Rotate the lift to align the notches with the pins. The springs will follow. The lift ring will then drop to the bottom of the liner.

Note the position of each lift pin. They will have to be returned to that position for reassembly. Push the lift pins up and out of the top of the liner to remove them.

The assembly of the lift ring is the reverse order of disassembly. Place the lift ring on a flat surface with the notches facing up. Put the liner in the center of the ring, and place a spring on each roll pin in the ring.

Install a lift pin in each of the 4 slots along the outside of the liner. The flat on the bottom of the lift pin should be flush to the diameter of the liner. Lift the ring up the liner, and engage all four lift pin slots in the notches on the ring. Rotate the ring so the four springs engage in the holes of the lift ring stop.

2. 450/450XL Lift Ring Assembly

Invert the liner and place on a flat surface. Locate the notched end of the snap ring that retains the lift ring, while pushing down on the lift ring in this area. Pry the snap ring out of its groove and continue all the way around the liner.

Remove the snap ring, and slide the ring up and off the liner. Now the 8 pins and springs can be removed from the liner.

Reverse the procedure to install a lift ring assembly on any 450/450XL liner.

B. Installation Of Liners

Before the liner is installed, make sure the outer surface of the liner is clean and the seat area in the frame is free of foreign matter. If a new o-ring is required, lubricate the o-ring and frame seating area with refrigeration oil. Slide the liner into the frame and align with the bore. Roll pin on the top of the liner can be orientated so if an imaginary line is drawn to opposite pins, it forms the letter "X". Seat the liner in the frame recess firmly by use of Vilter Cylinder Liner Tool (Vilter Part No. 33464A). A similar tool can be constructed. Be sure to protect the liner lapped seats to prevent damage.

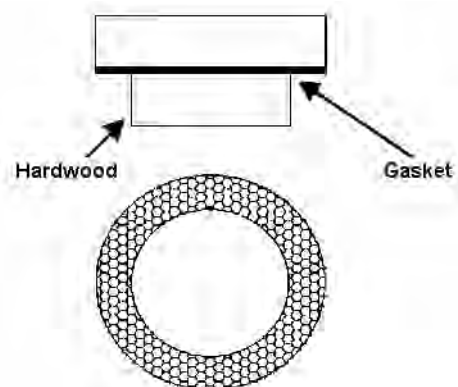


FIGURE 14. CYLINDER LINER ASSEMBLY TOOL

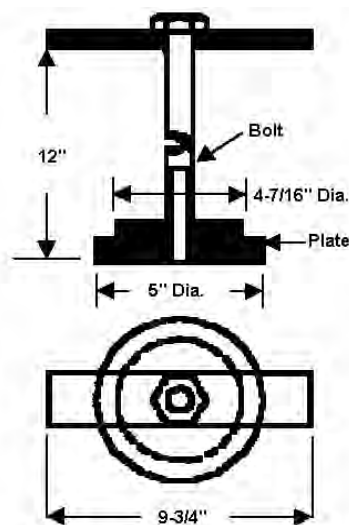


FIGURE 15. CYLINDER LINER REMOVAL TOOL

XIV. CRANKSHAFT

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A. General

Removing the crankshaft from the compressor is basically the same for all units, regardless of size. Because of a center bearing on all 12 and 16 cylinder compressors and the radius the 8 cylinder throws on the crankshaft, an extra step must be taken. A crankshaft may be removed from either end of the compressor. It is, however, easier to take the crankshaft out of the drive end of the frame. If the crankshaft is taken out of the pump end, the entire shaft seal must be removed.

B. Removal From Drive End

Remove any connections that will hinder the removal of the front bearing housing. When disconnecting the front oil line, be prepared to catch approximately 1 gallon of oil. Remove the shaft seal and inner retainer.

Replace the two $\frac{5}{8}$ " (15.88 mm) x 4" (101.6 mm) socket head screws with threaded studs to support the front housing during removal. Remove the $6\frac{5}{8}$ " (168.28 mm) x 2" (50.8 mm) cap screws that hold the housing to the frame. Using the 4" (101.6 mm) socket head screws, insert them into the tapped holes on both sides of the housing to aid in the removal of the front housing from the frame and off the front bearing. During this process, the housing will have a tendency to hang-up on the outer diameter of the bearing, thus pulling the entire shaft with it and possibly disengaging from the rear housing. Care must be taken to prevent this from happening. While the front housing is being removed, push on the crankshaft to be sure it is staying in the rear housing.

On a 458XL and 4516XL compressor, the rear housing will have to be removed, because the radius of the counterweight is larger than the radius of the front housing bore. Thus, the shaft will be hindered from coming straight out of the frame.

On a 12 or 16 cylinder compressor, the center bearing must be freed. At this time, remove the oil circuit piping tee in the middle of the oil cooler

side on the frame. Slip out the spring behind the tee with a piece of wire. Secure a $\frac{1}{2}$ "-13NCx10" long rod. Screw this into the threads in the end of the oil feed connector tube. Remove the tube from the frame with a slight pull on the rod. After the tube is taken out, separate the nut from the taper pin in the center bearing and tap the pin out of its hole. This releases the center bearing and allows the crankshaft to be removed.

Once the front housing is removed, the crankshaft should be blocked from inside the frame due to its weight. Adjust the blocking as the work proceeds so the crankshaft does not bump the front bore nor make any contact with the journals.

To aid in removal, a simple step can be added. Before removing the shaft from the rear housing, remove the rear bearing retainer and tap the center hole to 1 $\frac{1}{4}$ " (31.75 mm) NPT. Reinstall the retainer on the end of the crankshaft. A 1 $\frac{1}{4}$ " (31.75 mm) pipe can be threaded into it and used as an extension bar for handling the crankshaft during removal.

C. Removal From The Pump End

To pull the crankshaft from the pump end of the compressor, remove the pump cover filter adapter, the complete oil pump assembly and the rear bearing housing. The crankshaft does need to be blocked to prevent damage and on 12 and 16 cylinder compressors, the center bearing needs to be freed.

The shaft seal cover, shaft seal, and inner retainer will also have to be removed. All special notes apply to this method as well.

D. Servicing The Center Bearing (12 & 16 Cylinders)

The center bearing on this compressor is a split sleeve type bearing much like connecting rod bearings. To disassemble the bearing, remove the four bolts holding the halves of the center

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VILTER MultiCylinder Compressor

bearing housing together. The bearing inserts are snapped into place and can readily be removed by pushing them out by hand. Clean the bearing housing thoroughly before installing new inserts.

Snap the inserts into place. Lubricate the bottom half with refrigeration oil, and position it on the crankshaft. Do the same to the upper half, and locate it using the dowel pins provided. When aligned, bolt the halves together and tighten with a torque wrench to the values listed in Table 2, 3 or 4 (depending upon compressor model).

NOTE:

If oil dams are present on the center housing, they will need to be reinstalled if only changing the insert bearing. The current center housing does not require these dams.

E. Reinstallation

Whichever method was used to remove the crankshaft, extreme care is needed when placing the shaft back into the frame. Avoid any damage to the journals, and block the crankshaft once in position.

If the crankshaft was removed from the front end and the rear housing left in place with the oil pump, it is imperative the locating pin on the rear bearing align with the slot in the bottom of the rear housing bore. Also, the pump drive key must engage with the pump shaft.

If the unit is 12 or 16 cylinder, the center bearing must be guided into place. Align the hole in the bearing housing (for the oil feed connector tube) with hole in the frame. Screw the oil feed connector loosely on the end of the ½" (12.7 mm) threaded rod, and insert it into the hole. Push the tube into the bearing housing.

Unscrew the rod from the tube. Place the spring in the hole and screw in the "tee". Use thread sealant. Insert the taper pin in its hole. After placement, pin must be tightened. This expands the bearing housing so it fits tightly in the frame for quiet operation.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

MODIFICATION TO FRONT BEARING RETAINER AND FRONT BEARING COVER AFTER COMPRESSOR SERIAL NUMBER 21354 440 COMPRESSOR ONLY

Compressors below serial number 21355 were furnished with the front bearing cover assemblies A30294A (no longer available) for 2, 4, 6 and 8 cylinders, A32162A for 12 and 16 cylinders; front bearing retainer 38115A for 2, 4, 6 and 8 cylinders; or 33500A for 12 and 16 cylinders (without the oil hole). Former front bearing retainers (31885A or 33500A) without oil holes cannot be used with current bearing cover assemblies A36240A and A36241A. There is no provision for oil to get to the bearings.

If front bearing cover is being replaced, a current front bearing retainer must be ordered also, unless one of these current styles is already being used. If a current front bearing retainer is used with former style cover having an oil hole, remove orifice in cover and replace with solid $\frac{1}{8}$ " (3.2 mm) flush pipe plug.

SEE SKETCH BELOW FOR LOCATION AND DESCRIPTION OF OIL HOLE IN CURRENT BEARING RETAINER.

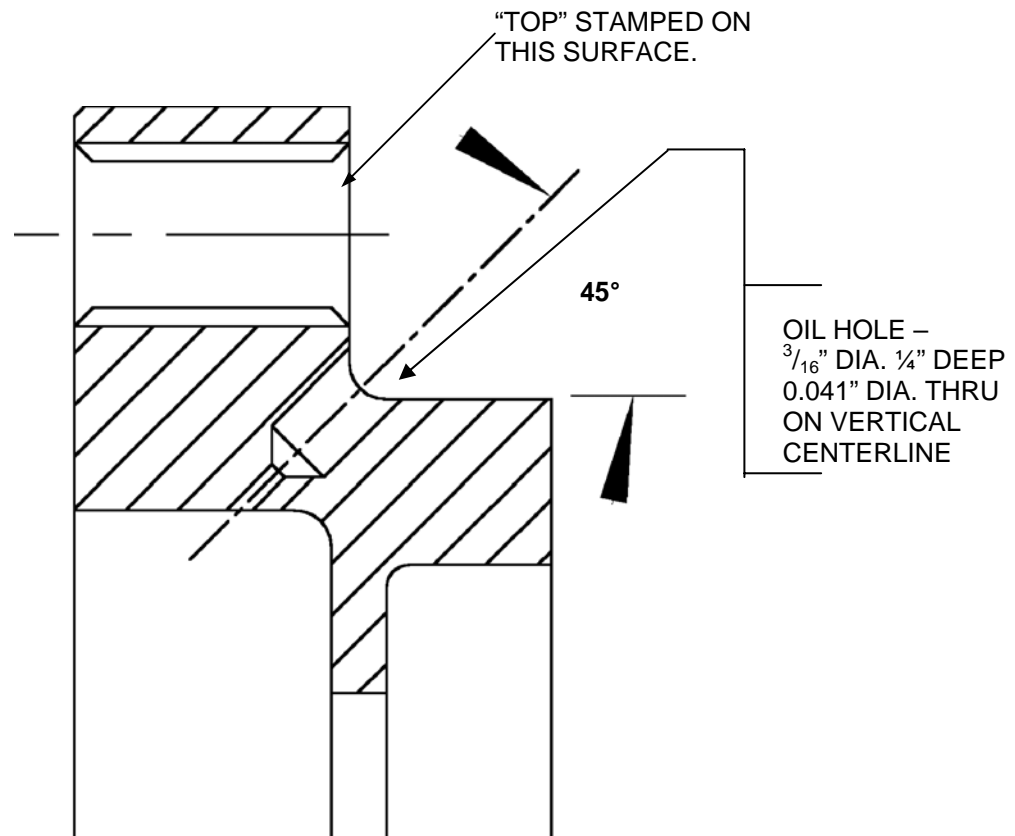


FIGURE 16. RETAINER PARTIAL VERTICAL CROSS SECTION

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**TABLE 2. TORQUE SPECIFICATION
VMC MODEL 440**

ITEM NO.	VPN	BOLT SIZE	GRADE	REQUIRED TORQUE	APPLICATION
102	13152L	$\frac{5}{8} \times 3\frac{1}{2}$	2	95 Ft. Lb.	Head Bolt with H2O Jacket
102	13152G	$\frac{5}{8} \times 2\frac{1}{2}$	2	95 Ft. Lb.	Head Bolt without H2O Jacket
112	13152C	$\frac{5}{8} \times 1\frac{1}{2}$	2	95 Ft. Lb.	Suction Screen Cover
112	13152D	$\frac{5}{8} \times 1\frac{3}{4}$	2	95 Ft. Lb.	Suction Screen Cover
112	13153E	$\frac{1}{2} \times 1\frac{1}{2}$	5	75 Ft. Lb.	Suction Screen Cover
112	13153D	$\frac{1}{2} \times 1\frac{1}{4}$	5	75 Ft. Lb.	Suction Screen Cover
121	13152E	$\frac{5}{8} \times 2$	2	95 Ft. Lb.	Safety Valve Cover
128	13153E	$\frac{1}{2} \times 1\frac{1}{2}$	5	75 Ft. Lb.	Handhole Cover
201	30651B			20 Ft. Lb.	Cap, Valve
209	13264B	Plug, $\frac{1}{4}$ Hex. Pipe Plug		20 Ft. Lb.	
210	13264C	Plug, $\frac{3}{8}$ Hex. Pipe Plug		35 Ft. Lb.	
213	13159E	$\frac{5}{8} \times 4$	5	100 Ft. Lb.	Front Bearing Cover
215	13153E	$\frac{5}{8} \times 2$	2	100 Ft. Lb.	Front Bearing Cover
216	13153Q	$\frac{1}{2} \times 4$	5	75 Ft. Lb.	Front Bearing Retainer
219	13153F	$\frac{1}{2} \times 1\frac{3}{4}$	5	75 Ft. Lb.	Shaft Seal Cover
224	31909	2 $\frac{1}{4}$ dia. X 18 Td/in.			Bearing Locknut
232	1736G	$\frac{5}{16} \times 1\frac{1}{2}$	2	11 Ft. Lb.	Rear Bearing Retainer
232	13160D	$\frac{5}{16} \times 1$	2	11 Ft. Lb.	Rear Bearing Retainer
236	11396D				(See Item 243)
243	1726E	$\frac{1}{2}$ " Nut	2	50 Ft. Lb.	Center Bearing Support-Half Bolt (Used on Item 236 $\frac{1}{2} \times 1\frac{3}{4}$ Bolt VPN 11396D)
244	13253F	$\frac{9}{16}$ " Nut	2	65 Ft. Lb.	Center Bearing Tapered Pin
247	31956A	1 x 1 $\frac{7}{8}$	2	250 Ft. Lb.	Flywheel Hub
302	13163E	$\frac{3}{4}$ " Hex Socket Pipe Plug		75 Ft. Lb.	
323	1689G	$\frac{7}{16} \times 2$	2	30 Ft. Lb.	Oil Filter Shell
326	13153E	$\frac{5}{8} \times 2$	2	100 Ft. Lb.	Rear Bearing Cover
327	13153F	$\frac{1}{2} \times 1\frac{3}{4}$	5	75 Ft. Lb.	Oil Pump Cover
341	13153E				Same as 326
342	13153F				Same as 327
419	1352D	$\frac{3}{8} \times 1$		20 Ft. Lb.	Yoke Assembly
509	2027A	$\frac{3}{8} \times 24$ Nut	8	*	Conn. Rod Cap
510	2028A	$\frac{3}{8}$ Palnut		*	Conn. Rod Cap w/Nut Lock
513	1776B	$\frac{3}{8}$ " Locknut	5	25 Ft. Lb.	Discharge Valve Retaining
510A	1472A	$\frac{3}{8}$ " Locknut	3	15-18 Ft. Lb.	Discharge Valve Retaining
518	31964A	$\frac{3}{8} \times 1\frac{3}{8}$	3	15-18 Ft. Lb.	Use with 510A
518	1527B	$\frac{3}{8} \times 1\frac{1}{2}$	3	20-25 Ft. Lb.	Use with 513

NOTE:

* Refer to 'Connecting Rod Nuts Tightening Instructions – VMC Compressors' on page 31.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

**TABLE 3. TORQUE SPECIFICATION
VMC MODEL 450**

ITEM NO.	VPN	BOLT SIZE	GRADE	REQUIRED TORQUE	APPLICATION
102	13152L	$\frac{5}{8} \times 3\frac{1}{2}$	2	95 Ft. Lb.	Cylinder Head
112	13152C	$\frac{5}{8} \times 1\frac{1}{2}$	2	95 Ft. Lb.	Suction Screen Cover
	13152D	$\frac{5}{8} \times 1\frac{3}{4}$	2	95 Ft. Lb.	Suction Screen Cover
	13153E	$\frac{1}{2} \times 1\frac{1}{2}$	5	75 Ft. Lb.	Suction Screen Cover
116	13164E	$\frac{3}{4}$ " Hex. Pipe Plug		75 Ft. Lb.	Plug
	13264D	$\frac{1}{2}$ " Hex. Pipe Plug		50 Ft. Lb.	Plug
121	13152E	$\frac{5}{8} \times 2$	2	95 Ft. Lb.	Safety Valve Cover
125	13153E	$\frac{1}{2} \times 1\frac{1}{2}$	5	75 Ft. Lb.	Handhole Cover
201	30641B			20 Ft. Lb.	Valve Cap
209	13264B	$\frac{1}{4}$ " Hex. Pipe Plug		20 Ft. Lb.	Front Bearing Cover
210	13264C	$\frac{3}{8}$ " Hex. Pipe Plug		35 Ft. Lb.	Front Bearing Cover
213	13159E	$\frac{5}{8} \times 4$	5	100 Ft. Lb.	Front Bearing Cover
215	13152E	$\frac{5}{8} \times 2$	2	100 Ft. Lb.	Front Bearing Cover
216	13153Q	$\frac{1}{2} \times 4$	5	75 Ft. Lb.	Front Bearing Retainer
219	13153F	$\frac{1}{2} \times 1\frac{3}{4}$	5	75 Ft. Lb.	Shaft Seal Cover
224					Bearing Locknut
232	1736G	$\frac{5}{16} \times 1\frac{1}{2}$	2	11 Ft. Lb.	Rear Bearing Retainer
236	11396D	$\frac{1}{2} \times 1\frac{3}{4}$		(See Item 243)	Bearing Support
243	1726E	$\frac{1}{2}$ " Nut (Item 236)	2	50 Ft. Lb.	Bearing Support Half
244	13253F	$\frac{9}{16}$ " Nut	2	65 Ft. Lb.	
245	1603A	$\frac{1}{4} \times \frac{1}{2}$	2	6 Ft. Lb.	
247	31956A	$1 \times 1\frac{1}{8}$	2	250 Ft. Lb.	Flywheel Hub
323	1689G	$\frac{1}{16} \times 2$	2	30 Ft. Lb.	Oil Filter Shell
334	13152E	$\frac{5}{8} \times 2$	2	95 Ft. Lb.	Rear Bearing Cover
335	13153F	$\frac{1}{2} \times 1\frac{3}{4}$	5	75 Ft. Lb.	Oil Pump
419	1352D	$\frac{3}{8} \times 1$		20 Ft. Lb.	Yoke Assembly
509	2027A	$\frac{3}{8} \times 24$ Nut	8	*	Connection Rod Cap
510	2028A	$\frac{3}{8}$ Palnut		*	Connection Rod Cap

NOTE:

* Refer to 'Connecting Rod Nuts Tightening Instructions – VMC Compressors' on page 31.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

**TABLE 4. TORQUE SPECIFICATION
VMC MODEL 450XL**

ITEM NO.	VPN	BOLT SIZE	GRADE	REQUIRED TORQUE	APPLICATION
102	13152L	$\frac{5}{8} \times 3\frac{1}{2}$	2	95 Ft. Lb.	Cylinder Head
112	13152E	$\frac{5}{8} \times 2$	2	95 Ft. Lb.	Suction Screen Cover
	13153E	$\frac{1}{2} \times 1\frac{1}{2}$	5	75 Ft. Lb.	Suction Screen Cover
116	13264E	$\frac{3}{4}$ " Hex Pipe Plug		75 Ft. Lb.	Plug
	13264D	$\frac{1}{2}$ " Hex Pipe Plug		50 Ft. Lb.	Plug
121	13152E	$\frac{5}{8} \times 2$	2	95 Ft. Lb.	Safety Valve Cover
125	13153E	$\frac{1}{2} \times 1\frac{1}{2}$	5	75 Ft. Lb.	Handhole Cover
201	30651B			20 Ft. Lb.	Valve Cap
209	13264B	$\frac{1}{4}$ " Hex Pipe Plug		20 Ft. Lb.	Front Bearing Cover
210	13264C	$\frac{3}{8}$ " Hex Pipe Plug		35 Ft. Lb.	Front Bearing Cover
213	13159E	$\frac{5}{8} \times 4$	5	100 Ft. Lb.	Front Bearing Cover
215	13153E	$\frac{5}{8} \times 2$	2	100 Ft. Lb.	Front Bearing Cover
216	13153Q	$\frac{1}{2} \times 4$	5	75 Ft. Lb.	Front Bearing Retainer
219	13153F	$\frac{1}{2} \times 1\frac{3}{4}$	5	75 Ft. Lb.	Shaft Seal Cover
224	KT 367				Bearing Locknut
232	1736G	$\frac{5}{16} \times 1\frac{1}{2}$	2	11 Ft. Lb.	Rear Bearing Retainer
236	13153F	$\frac{1}{2} \times 1\frac{3}{4}$			Machine Bolt
243	1726E	$\frac{1}{2}$ " Nut	2	50 Ft. Lb.	Bearing Support Half
244	13253F	$\frac{9}{16}$ " Nut	2	65 Ft. Lb.	
247	31956A	$1 \times 1\frac{1}{8}$	2	250 Ft. Lb.	Flywheel Hub
323	1689G	$\frac{7}{16} \times 2$	2	30 Ft. Lb.	Oil Filter Shell
334	13153E	$\frac{5}{8} \times 2$	2	95 Ft. Lb.	Rear Bearing Cover
335	13153F	$\frac{1}{2} \times 1\frac{3}{4}$	5	75 Ft. Lb.	Oil Pump
419	1352D	$\frac{3}{8} \times 1$		20 Ft. Lb.	Yoke Assembly
504	2027A	$\frac{3}{8} \times 24$ Nut	8	*	Connection Rod Cap
505	2028A	$\frac{3}{8}$ " Palnut		*	Connection Rod Cap

NOTE:

* Refer to 'Connecting Rod Nuts Tightening Instructions – VMC Compressors' on page 31.

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

CONNECTING ROD NUTS TIGHTENING INSTRUCTIONS VMC COMPRESSORS

All VMC Compressor connecting rod bolts use a plain nut with a spring steel locknut ("Palnut[®]") combination.

PLAIN NUTS

Plain nuts may be re-used. Torque the plain nuts as follows:

<u>Connecting Rod Assembly</u>	<u>Torque Value</u>
A33171A (Aluminum)	18 to 21 ft. lb. (24 to 28 Nm)
A31045D (Steel)	30 to 35 ft. lb. (41 to 48 Nm)
A34762A (Steel)	30 to 35 ft. lb. (41 to 48 Nm)

LOCK NUTS

New, unused locknuts ("Palnuts") must be used each time the connecting rods are serviced. After the plain nut is torqued to the specified value, assemble the palnut to the rod bolt with the open end of the hexagon pointing away from the hex, plain nut.

CAUTION:

OPEN END MUST POINT AWAY FROM PLAIN NUT. If palnut is installed the other way, it will not lock and will eventually work loose, during operation.

Turn the palnut until the mating parts are pulled together and tightening begins. Final tightening and locking of the palnut is achieved by an additional 1/3 to 1/2 (maximum) turn. Order spare palnuts by Vilter part number 2028A.

SOCKET

A special, shallow hexagon socket is available for easier assembly. This socket is $\frac{7}{8}$ " in diameter, $2\frac{1}{4}$ " long and has a $\frac{3}{8}$ " square socket drive. The socket is specially made for this type of nut, allowing more convenient gripping and tightening of the palnut. Order Vilter part number 2040A.

TORQUE LIMIT ADAPTOR

Also available is a torque limit adaptor. This lightweight, compact, rugged, and square male drive tool is factory set to a predetermined torque value. Use with any socket driving device. The adaptor allows the accurate torquing of the plain nut to the specified value in the confined crankcase space. One adaptor is needed for each different connecting rod. Order by part number listed below:

<u>Adaptor Part No.</u>	<u>Drive</u>	<u>Overall Dimension</u>	<u>Torque Limit Setting</u>	<u>Use w/Rod</u>
2287A	$\frac{3}{8}$ "	$1\frac{3}{8}$ "	19 ft. lb. (26 Nm)	A33171A
2287B	$\frac{1}{2}$ "	$1\frac{5}{8}$ "	33 ft. lb. (45 Nm)	A31045D
2287B	$\frac{1}{2}$ "	$1\frac{5}{8}$ "	33 ft. lb. (45 Nm)	A34762A

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

TABLE 5. FACTORY RUNNING DIMENSIONS, TOLERANCES, CLEARANCES & ALLOWABLE WEAR LIMITS FOR 440, 450 & 450XL VMC COMPRESSORS

ITEM	PART NAME	COMPRESSOR SIZE	DIMENSION	TOLERANCE	CLEARANCE	MAXIMUM ALLOWABLE WEAR
1	Crankshaft Main Brg. Journal Drive End	2, 4, 6, 8 8 HD, 12, 16 450XL – ALL	2.8145 Dia. 3.1895 Dia.	+ .000 - .001 + .000 - .001	- .0015 .0000 - .0020 - .0005	NONE
	Pump End	ALL	2.8140 Dia.	+ .000 - .001	- .0015 .0000	
2	Timken Bearings I.D. Drive End	2, 4, 6, 8 8 HD, 12, 16 450XL – ALL	2.8125 3.1875	+ .0005 - .0000	PRESS FIT ONTO SHAFT	NONE
	Pump End	ALL	2.8125	+ .0005 - .0000		
	Mounted	2, 4, 6, 8	.0073 .0002	.0071	.0073 .0002	.009" MAX. END PLAY
		8 HD, 12, 16 450XL – ALL	.0074 .0008	.0068	.0074 .0008"	
1	Crankshaft Crankpin Std. Size	ALL Except 450XL	2.874 Dia.	+ .000 - .001	.0015 to .0036	.002
	.015" U.S.	ALL Except 450XL	2.859			
	.030 U.S.	ALL Except 450XL	2.844			
	Std. Size	450XL All Models	3.124			
	.015" U.S. .030" U.S.	450XL (ALL) 450XL (ALL)	3.109 3.094			

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

TABLE 5. FACTORY RUNNING DIMENSIONS, TOLERANCES, CLEARANCES & ALLOWABLE WEAR LIMITS FOR 440, 450 & 450XL VMC COMPRESSORS (cont'd)

ITEM	PART NAME	COMPRESSOR SIZE	DIMENSION	TOLERANCE	CLEARANCE	MAXIMUM ALLOWABLE WEAR
3	Connecting Rod I.D. w/Large End Brgs. Installed Std.	ALL Except 450XL	2.8755	+.0011 -.0000	.0015 to .0036	.001
		450XL (ALL)	3.1255			
	W/.015" U.S. Brgs. Installed	ALL Except 450XL	2.8605			
		450XL (ALL)	3.1105			
	W/.030" U.S. Brgs. Installed	ALL Except 450XL	2.8455			
		450XL	3.0955			
4	Shell Bearing Thickness Std. .015" U.S. .030 U.S.	ALL ALL ALL	.0750 .0825 .0900	+.0000 -.0003	None (Brg. to Rod)	.0005
3	Connecting Rod	ALL	.994"	.001"		.001" No Scuffing
	Width		.993"			
	Side Clearance	ALL	.006" Each rod	+.001"		.001"
1	Crankshaft Center Brg.	12, 16	3.999	+.000 -.001	.0020 to .0046 Theoretical Vertical	.002"
4	Shell Bearings I.D.		4.0010	+.0026 -.0000		.0005"
	Thickness		.1255	+.0000 -.0003		
5	Piston	ALL	4.4955 *	+.000 -.001	.0045 to .0065	.001"
6	Cylinder Bore		4.500	+.001 -.000		.0035" to .0055" (Loose)
	O.D.		5.9965	.001		
			5.9955			
7	Frame Bore		6.000	+.001 -.000		

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

TABLE 5. FACTORY RUNNING DIMENSIONS, TOLERANCES, CLEARANCES & ALLOWABLE WEAR LIMITS FOR 440, 450 & 450XL VMC COMPRESSORS (cont'd)

ITEM	PART NAME	COMPRESSOR SIZE	DIMENSION	TOLERANCE	CLEARANCE	MAXIMUM ALLOWABLE WEAR
5	Piston Pin Bore	ALL (Except 450XL)	1.1250	.0002	Finger Tight (Dry)	Drops thru
			1.1248			
		450XL (ALL)	1.1241	.0003	Tight .0007 .0012	None
			1.1238			
	Pin Dia.	ALL	1.1250	+.0000 -.0002	See Above Pin Bore	.0005"
3	Connecting Rod Pin Bushing (I.D.)	ALL	1.1257	.0003	.0004 to .0009	.001"
			1.1254			
8	Rings, Piston End Gap Compression	ALL	.013/.025	.012	Meas. In 4.500 Bore	.025"
	Oil (Solid)		.013/.023	.010		.025"
	Oil (Flex)					
	Oil (Rails)					
	Fit in Groove				Meas. In Piston Groove	.002
	Compression		.002/.004	.002		
	Oil (Solid)		.0015/.004	.0025		
	Oil (Flex) With Rails					
9	Suction Valve Thickness	ALL	.061"	±.003"	None	None
6	Cylinder Valve Seat Height	ALL	.036" To .026"	.010"	None	None (Lapped Flat to Seat)
	To Top of Liner		.134" To .132"	.002"	None	None (Lapped Flat to Seat)
	Piston Top to Bottom Of Safety Head	ALL	.035" .012"	.023"	.012"	Must be Measured. Minimum .010"

* Dimension does not apply to assembled 450XL piston on connecting rod (piston shrink fit to wrist pin).

VILTER MANUFACTURING CORPORATION

VILTER MultiCylinder Compressor

TABLE 5. FACTORY RUNNING DIMENSIONS, TOLERANCES, CLEARANCES & ALLOWABLE WEAR LIMITS FOR 440, 450 & 450XL VMC COMPRESSORS (cont'd)

ITEM	PART NAME	COMPRESSOR SIZE	DIMENSION	TOLERANCE	CLEARANCE	MAXIMUM ALLOWABLE WEAR
10	Discharge Valve Thickness	440 ALL	.030"	±.001"	None	None
		450 ALL	.040"	±.002"	None	None
	Height of Disch. Valve Seat	ALL	1/32"	±.010"	None	Measured From Head To Rail .005" Minimum Height
11	Oil Pump Axial Clearance (#2 Pump)	ALL	.003"	.003"	.003"	.002"
			.006"		.006"	

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VILTER MultiCylinder Compressor

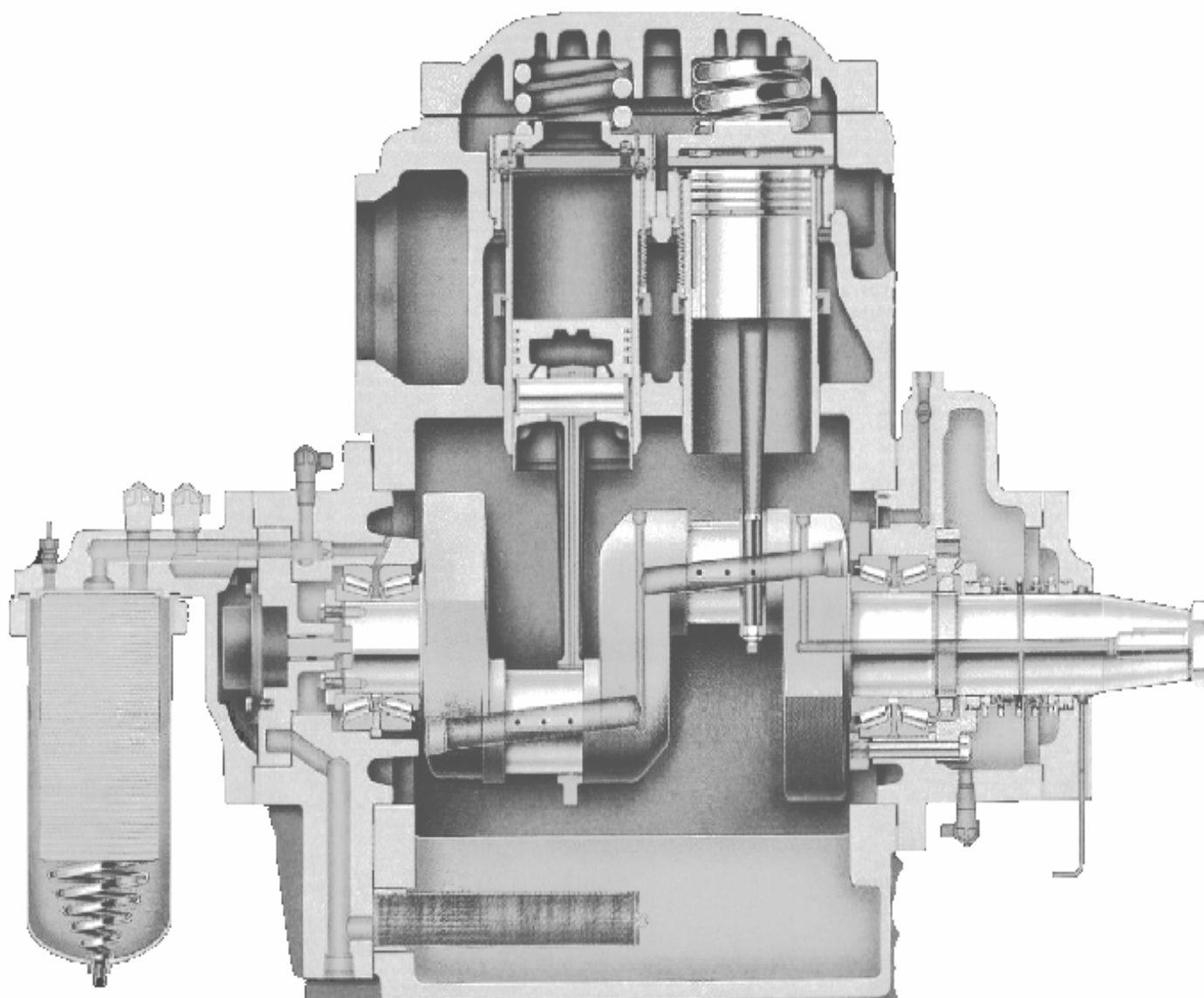


FIGURE 17. TYPICAL 400 SERIES COMPRESSOR VERTICAL CROSS SECTION AND LUBRICATION SYSTEM

**450XL® * VMC COMPRESSORS
REPLACEMENT PARTS LIST**

(Note: Except where noted in the description column,
part listed apply to all 450XL High Stage, Booster, and
Two-Stage Compressors.)

TABLE OF CONTENTS

<u>PAGE</u>	
1	REPLACEMENT PARTS ORDERING INSTRUCTIONS
	BASIC FRAME REPLACEMENT PARTS
2	Illustration, 2 Cylinder (Figure 1)
3	Illustration, 4, 6 & 8 Cylinder (Figure 2)
4	Illustration, 12 & 16 Cylinder (Figure 3)
5	Parts List
	DISCHARGE/SUCTION GAUGE
9	Illustration (Figure 4)
10	Parts List
	CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
9	Illustration (Figure 5)
10	Parts List
	REAR BEARING COVER REPLACEMENT PARTS
12	Illustration (Figure 6)
13	Parts List
	CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
14	Illustration (Figure 7)
15	Parts List
	PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS
16	Illustration (Figure 8)
17	Parts List
18	RECOMMENDED SPARE PARTS LIST

REPLACEMENT PARTS ORDERING INSTRUCTIONS

1. Give the size, voltage, original order number and serial number of the compressor. All of this information is stamped on the nameplate attached to the compressor frame. The serial number is also stamped on the compressor frame. The compressor frame serial number location is directly above the suction flange on the frame of the compressor or directly above the rear bearing cover. The rear bearing is located on the oil pump/filter end of the compressor.
2. Always give the name of the part as well as the corresponding part number and/or item number. Also include the quantity of parts required.
3. Should there be a doubt regarding the part number or name, send a sketch of the part required or return the old part as a sample, transportation charges prepaid. Orders on which part numbers and description do not agree will be filled according to our best interpretation.
4. All prices are F.O.B. factory. Minimum domestic parts order is \$75.00 net price.
5. Please indicate on the order preferred method of shipment. We will follow your instructions unless it is to your best interest to change routing.
6. If you purchased the compressor from a party other than Vilter Manufacturing Corporation, please state when you purchased the compressor and from whom.

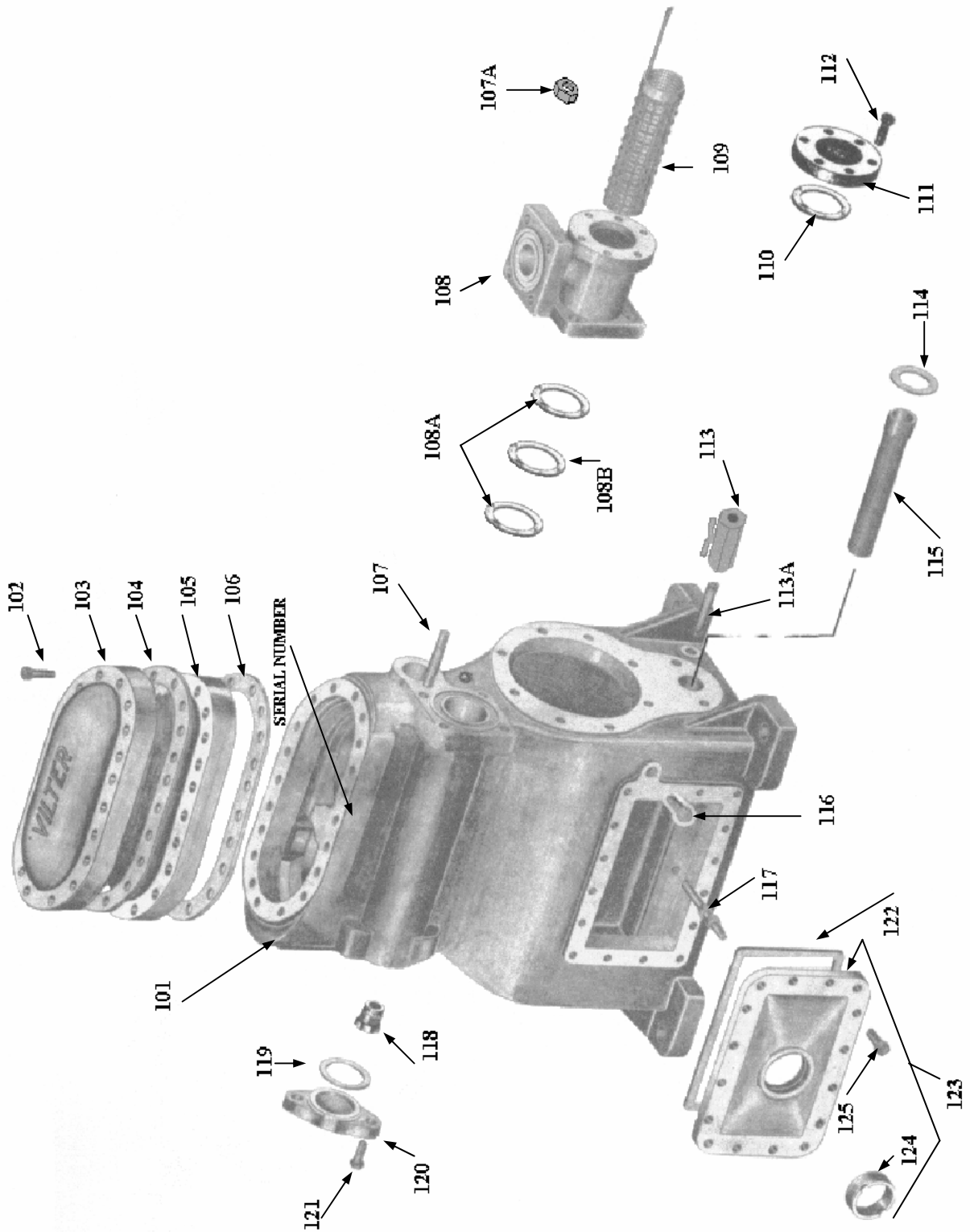
* Patents Pending

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February 2001
Replaces
May 1985

450XL® * VMC COMPRESSORS

**2 CYLINDER BASIC FRAME REPLACEMENT PARTS
FIGURE 1**



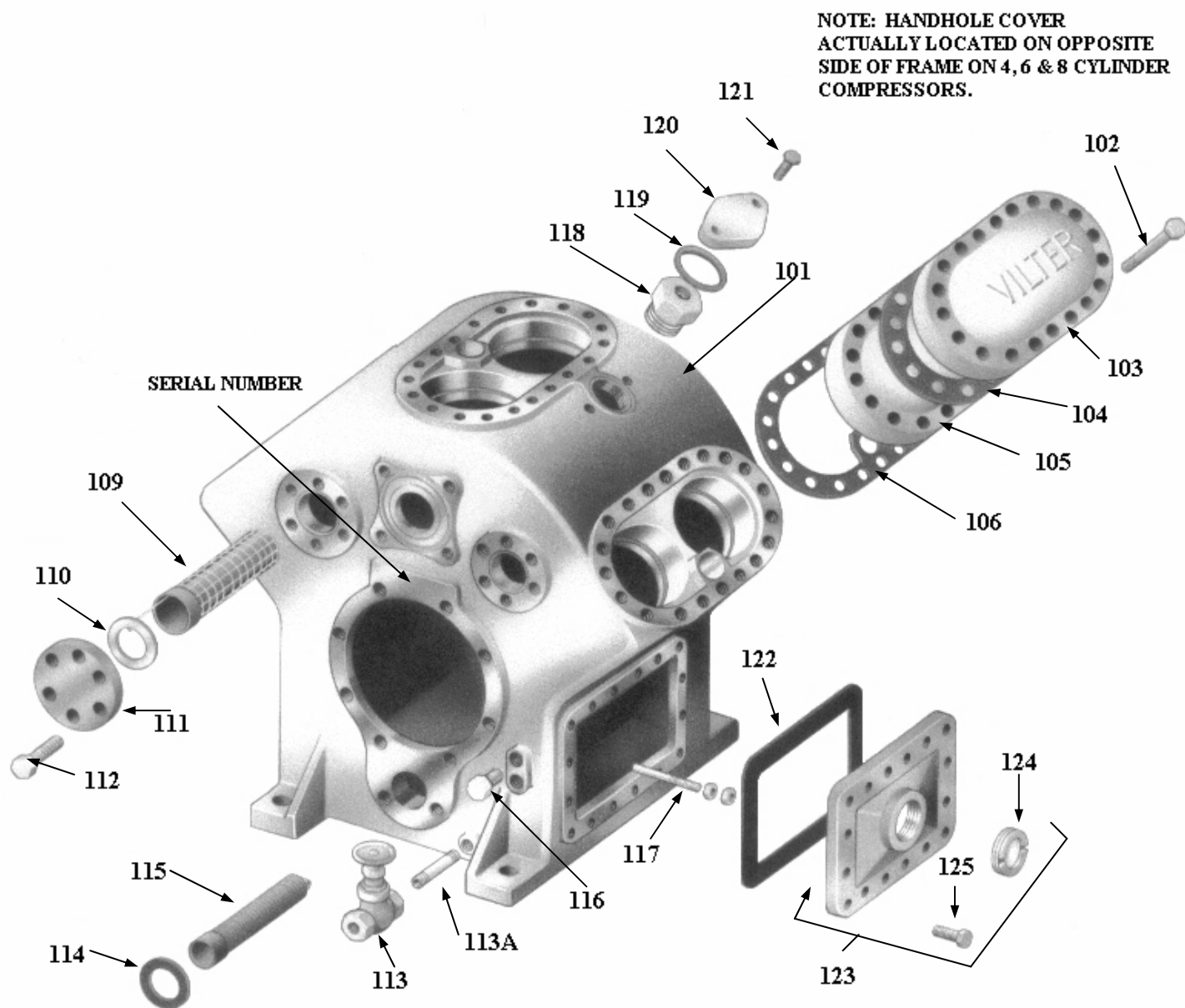
February 2001
Replaces
May 1985

VILTER MANUFACTURING CORPORATION

SECTION 100-R
PAGE 3

450XL® * VMC COMPRESSORS

4, 6 AND 8 CYLINDER BASIC FRAME REPLACEMENT PARTS FIGURE 2

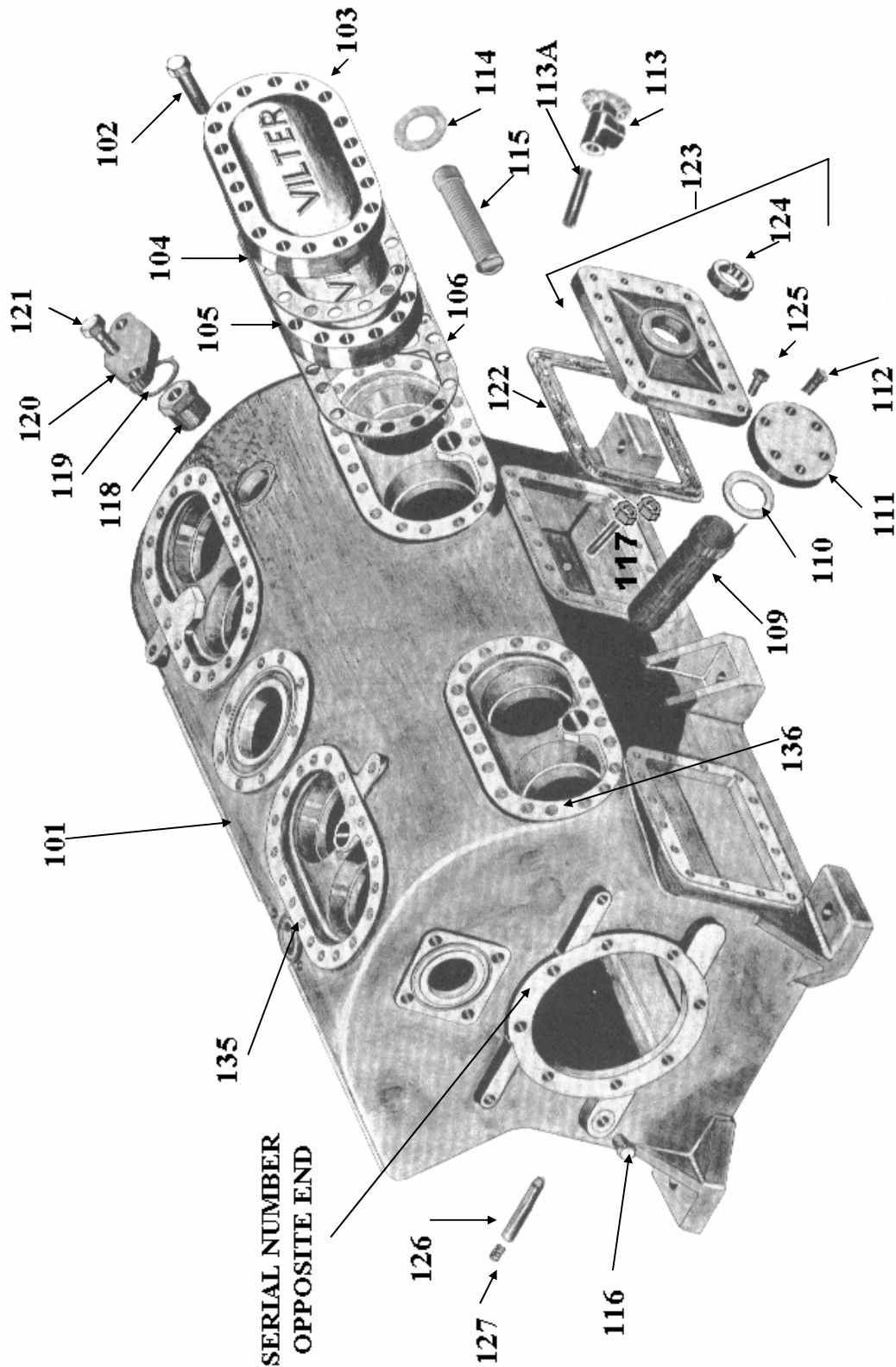


VILTER MANUFACTURING CORPORATION

450XL® * VMC COMPRESSORS

February 2001
Replaces
May 1985

12 AND 16 CYLINDER BASIC FRAME REPLACEMENT PARTS
FIGURE 3



450XL® * VMC COMPRESSORS

BASIC FRAME REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
101	Frame	1	1	1	1	1	1	+
102	Screw, $\frac{5}{8}$ " x $3\frac{1}{2}$ " Hex Head Cap (Used with Water Jacket)	20	40	60	80	120	160	13152L
102	Screw, $\frac{5}{8}$ " x $2\frac{1}{2}$ " Hex Head Cap (Used when Water Jacket not used)	20	40	60	80	120	160	13152G
103	Cover, Water Jacket (Ammonia and R22)	1	2	3	4	6	8	30299A
104	Gasket, Water Jacket (Ammonia and R22)	1	2	3	4	6	8	33329A
105	Cover, Cylinder							
	Banks w/o Capacity Reduction	--	1	--	2	--	4	A30332A
	Banks w/Capacity Reduction (Oil Act.)	--	1**	--	2**	--	4**	30332B
	Banks w/Capacity Reduction (Gas Act.)	--	1	--	2	--	4	30332G
	Banks w/o Capacity Reduction	1	--	1	--	2	--	A30364A
	Banks w/Capacity Reduction (Oil Act.)	1**	--	2**	--	4**	--	30364B
	Banks w/Capacity Reduction (Gas Act.)	1**	--	2**	--	4	--	30364G
	Banks w/o Capacity Reduction (Two-Stage)	--	--	3	--	6	--	A30364A
106	Gasket, Cylinder Cover	1	2	3	4	6	8	33330A
107	Stud, $\frac{5}{8}$ " x 3" (shown only on 2 cylinder)	8	4	4	4	8	8	13156D
107	Stud, $\frac{3}{4}$ " x $3\frac{1}{4}$ " (not shown)	--	4	4	4	--	--	13157D
107A	Nut, 5/8-11NC-2B							1726G
107A	Nut, $\frac{3}{4}$ -10NC-2B	--	4	4	4	--	--	1726H
108	Tee, Suction (++)							
	2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ "	1	--	--	--	--	--	A30319A
	3 $\frac{1}{2}$ " x 3"	--	1	--	--	--	--	A32417B
	Elbow, Discharge (++)							
	2" x 2" (Ammonia)	1	--	--	--	--	--	12270E
	2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " (Ammonia)	--	1	--	--	--	--	12270F
	3" x 3" (Ammonia)	--	--	1	--	2	2	12271E
	4" x 3" (Ammonia)	--	--	--	1	--	--	A32498A
109	Suction Screen	--	1	--	--	--	--	A32428A
109	Suction Screen	--	--	--	1	--	--	A32428D
109	Suction Screen	--	--	--	--	2	2	A32565A
109-A	Bag, Suction Screen (not shown)	--	1	--	--	--	--	A33474A
109-A	Bag, Suction Screen (not shown)	1	--	2	3	--	--	A33474B
109-A	Bag, Suction Screen (not shown)	--	--	--	--	2	2	A33474G
110	Gasket, Suction Screen Cover	1	--	2	2	--	--	31892A
110	Gasket, Suction Screen Cover	--	--	--	--	2	2	33493A
110	Gasket, Suction Cover	--	1	--	1	--	--	11323J
111	Cover, Suction Screen	1	--	2	2	--	--	31893A
111	Cover, Suction Screen	--	--	--	--	2	2	33492A
111	Cover, Suction Screen	--	1	--	1	--	--	13706A
112	Screw, $\frac{5}{8}$ " x 2" Hex Head Cap	--	5	--	5	--	--	13152E
112	Screw, $\frac{1}{2}$ " x $\frac{1}{2}$ " Hex Head Cap	6	--	12	12	16	16	2796E
113	Valve, $\frac{1}{2}$ " Oil Charge and Drain (Ammonia)	1	1	1	1	1	1	1956B
113	Valve, $\frac{1}{2}$ " Oil Charge and Drain (Halocarbon)	1	1	1	1	1	1	1956A
113-A	Nipple, $\frac{1}{2}$ " x 4" Sch. 80 Pipe	1	1	1	1	1	1	13189G
114	Gasket, Crankcase Oil Screen	1	1	1	1	1	1	31889A
115	Crankcase Oil Screen Assembly	1	1	1	1	1	1	A31886A
116 ++	Plug, $\frac{3}{4}$ " Hex Head Pipe (not shown on 12 & 16)	1	1	1	1	1	1	13264E
116 ++	Plug, $\frac{1}{2}$ " Hex Head Pipe (not shown on 2 thru 8)	1	1	1	1	1	1	13264D

NOTES:

A. Unless otherwise indicated, quantities shown are for compressors with standard capacity reduction, and may vary if compressor is equipped with other versions. See Page 13 for application notes.

* Patents Pending.

** Items shown are for compressors with optional oil unloading or optional single cylinder unloading. See Page 15 for application notes.

+ Part Number on application.

++ May not be shown, or only shown typically on one illustration.

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
May 1985

450XL® * VMC COMPRESSORS

BASIC FRAME REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
117	Pin Assembly, Crankcase Oil Screen Retaining	1	1	1	1	1	1	A31936A
118	Safety Valve (Internal Relief)	1	1	1	1	2	2	1721C
119	Gasket, 2" Flange	1	1	1	1	2	2	11323G
120	Cover, Safety Valve	1	1	1	1	2	2	31954A
121	Screw, 5/8" x 2" Hex Head Cap	2	2	2	2	4	4	13152E
122	Gasket, Handhole Cover (Chain)	1	1	1	1	2	2	35382A
122	Gasket, Handhole Cover (Strip)	1	1	1	1	2	2	31894A
123 & 124	Handhole Cover and 2" Sight Glass Assy With openings for:							
	560W NEMA 1 & 7 Htr., F.V. & Therm.	1	1	1	1	1	1	A33034G
	560W NEMA 1 & 7 Heater and Therm.	1	1	1	1	1	1	A33034L
123	Cover, Handhole (with openings)	1	1	1	1	1	1	Order Assy
123A	Cover, Handhole (without openings) (not shown)	--	--	--	--	1	1	33034B
124	Glass, Oil Sight - 2"	1	1	1	1	1	1	1484A
125	Screw, 1/2" x 1 1/2" Hex Head Cap	16	16	16	16	32	32	2796E
126	Tube, Oil Feed Connector	--	--	--	--	1	1	33494A
127	Spring	--	--	--	--	1	1	31789A
135	Hex Head Plug Long Shank Unloader Hold Down	--	--	1	--	2	--	35166A
136	Hex Head Plug Short Unloader Hold Down							

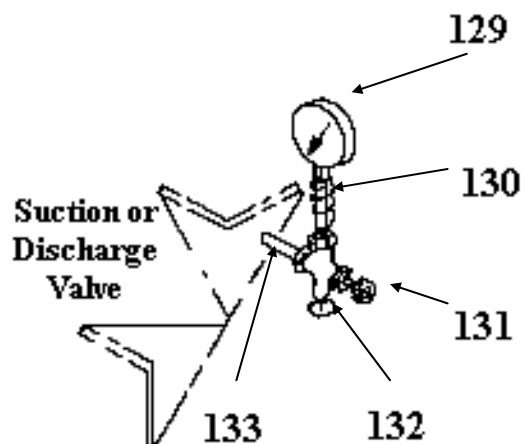
NOTES:

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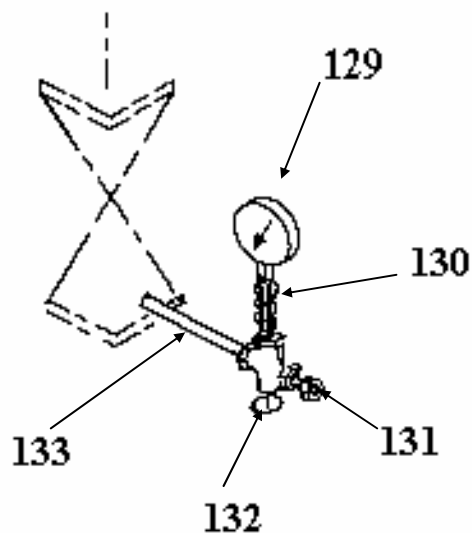
450XL® * VMC COMPRESSORS

**DISCHARGE / SUCTION GAUGE REPLACEMENT PARTS
FIGURE 4**

**USED ON 2 THRU 4
CYLINDER
COMPRESSORS**



**USED ON 12 AND
16 CYLINDER
COMPRESSORS**



VILTER MANUFACTURING CORPORATION

February 2001
Original Issue

450XL® * VMC COMPRESSORS

DISCHARGE / SUCTION GAUGE REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
128	Heater, Electric Crankcase Oil, 115V (not shown)	1	1	1	1	2	2	2069J
128	Heater, Electric Crankcase Oil, 230V (not shown)	1	1	1	1	2	2	2069K
129	Gauge, Discharge, 300 PSI	1	1	1	1	2	2	1204E
129	Gauge, Suction, 150 PSI	1	1	1	1	1	1	1204C
130	Stedy-Mount®	2	2	2	2	3	3	A17311SS
131	Connector, ¼" MPT x ¼" O.D. Compression	2	2	2	2	3	3	13229D
133	Nipple ¼" x 4" Sch. 80 Pipe	2	2	2	2	3	3	13181G
134	Thermometer, Crankcase Oil (not shown)	1	1	1	1	1	1	1467F

* Patents Pending.

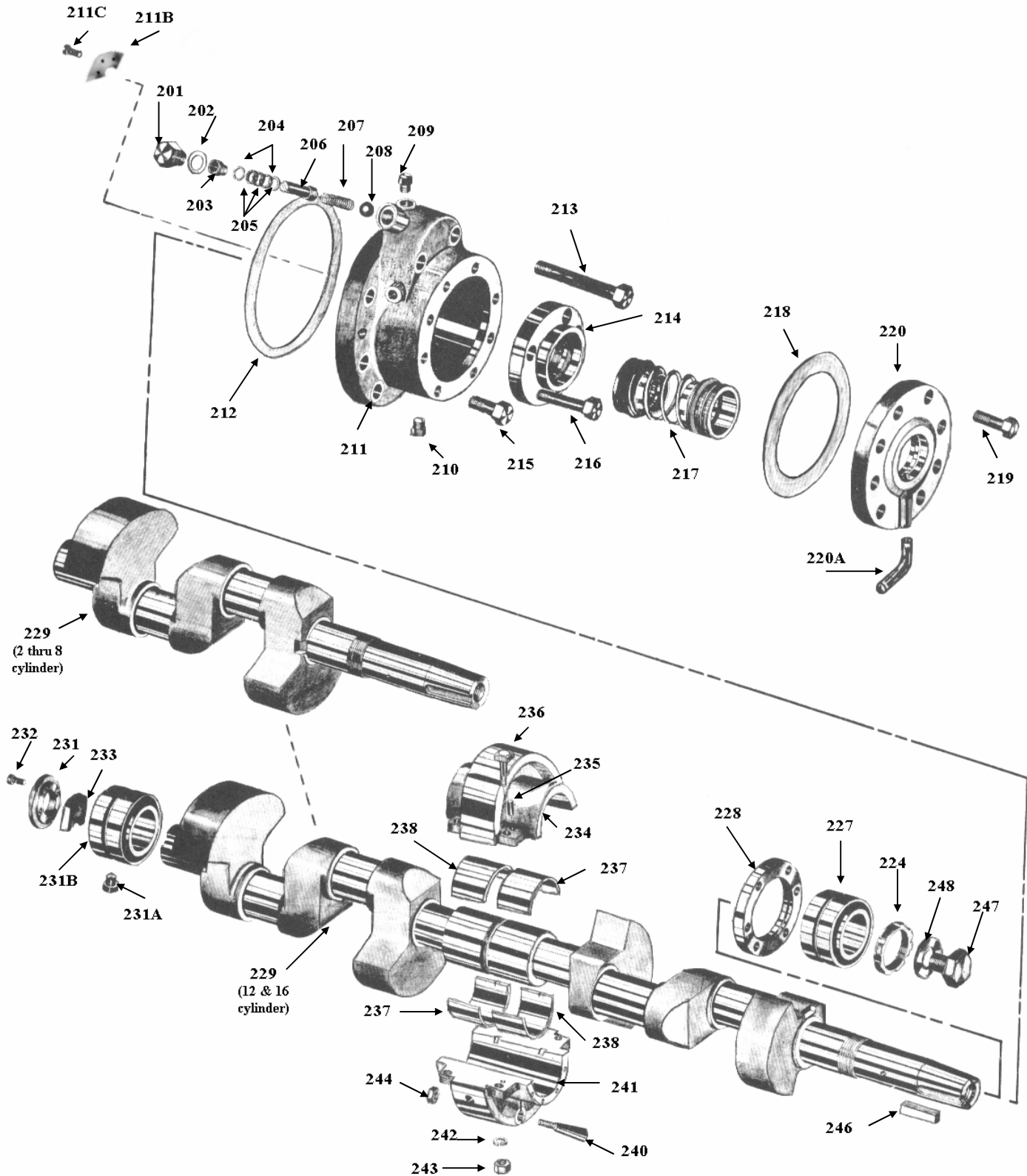
February 2001
Replaces
May 1985

VILTER MANUFACTURING CORPORATION

SECTION 100-R
PAGE 9

450XL® * VMC COMPRESSORS

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
FIGURE 5



PATENTS PENDING

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
May 1985

450XL® * VMC COMPRESSORS

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
201 thru 211	Front Bearing Cover and Relief Valve Assy	1	1	1	1	1	1	A32566A
201	Cap, Valve	1	1	1	1	1	1	17355A
202 thru 208	Oil Relief Valve Kit	1	1	1	1	1	1	KT486
202	Gasket, Valve Cap	1	1	1	1	1	1	30651C
203	Nut, Packing	1	1	1	1	1	1	31048A
204	Washer	2	2	2	2	2	2	31048D
205	Packing, $\frac{7}{8}$ " O.D. x $\frac{39}{64}$ " I.D. x $\frac{3}{8}$ "	1	1	1	1	1	1	31048E
206	Stem, Valve	1	1	1	1	1	1	31048C
207	Spring	1	1	1	1	1	1	31048F
208	Ball, $\frac{5}{8}$ " dia. Steel	1	1	1	1	1	1	13155K
209 thru 211	Front Bearing Cover Assembly	1	1	1	1	1	1	A36241A
209	Plug, $\frac{1}{4}$ " Hex Head Pipe	1	1	1	1	1	1	13264B
210	Plug, $\frac{3}{8}$ " Hex Head Pipe	1	1	1	1	1	1	13264C
211	Cover, Front Bearing	1	1	1	1	1	1	Order Assy
211B	Shield, Splash	1	1	1	1	1	1	35274A
211C	Screw, Hexagon Hd. No. 10-32 x $\frac{3}{8}$ " long	3	3	3	3	3	3	2583A
212	Gasket, Bearing Cover	1	1	1	1	1	1	31890A
213	Screw, $\frac{5}{8}$ " x 4" Hex Socket Head Cap	2	2	2	2	2	2	13159E
214	Retainer, Front Bearing (with Oil Hole)	1	1	1	1	1	1	33500A
215	Screw, $\frac{5}{8}$ " x 2" Hex Head Cap	6	6	6	6	6	6	13152E
216	Screw, $\frac{1}{2}$ " x 4" Hex Head Cap	3	3	3	3	3	3	2796EV
217 & 218	Seal and Gasket Kit	1	1	1	1	1	1	KT509
217	Seal, Rotary Shaft Assembly	1	1	1	1	1	1	A33489A
218	Gasket, Shaft Seal Cover	1	1	1	1	1	1	33496A
219	Screw, $\frac{1}{2}$ " x $1\frac{1}{4}$ " Hex Head Cap	8	8	8	8	8	8	2796EL
220 & 220A	Cover and Tube Assembly, Shaft Seal	1	1	1	1	1	1	A32564A
220A	Drain Tube	1	1	1	1	1	1	35078A
224	Crankshaft and Bearings Assembly *	1	--	--	--	--	--	A34555HX
Thru	Crankshaft and Bearings Assembly *	--	1	--	--	--	--	A34555KX
233	Crankshaft and Bearings Assembly *	--	--	1	--	--	--	A34555LX
	Crankshaft and Bearings Assembly *	--	--	--	1	--	--	A34555BX
224 thru	Crankshaft and Bearings Assembly Kit *	--	--	--	--	1	--	KT588
244 less +	Crankshaft and Bearings Assembly Kit *	--	--	--	--	--	1	KT589
224	Locknut and Retaining Compound Kit	1	1	1	1	1	1	KT367
227	Front Bearing and Retaining Compound Kit	1	1	1	1	1	1	KT369
228	Ring, Front Bearing Retainer	1	1	1	1	1	1	33145A
229	Crankshaft and Retaining Compound Kit *	--	--	--	--	--	--	See Assembly Above

NOTES:

- + Less items 234, 235 and 241.
* Patents Pending.

February 2001

Replaces

May 1985

VILTER MANUFACTURING CORPORATION**450XL® * VMC COMPRESSORS**

SECTION 100-R

PAGE 11

May 1985

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
229A	Plug, $\frac{1}{8}$ " Pipe, Hex Socket Head (not shown)	3	3	3	3	5	5	13163A
229B	Plug, $\frac{3}{4}$ " Pipe, Hex Socket Head (not shown)	2	2	2	2	4	4	2606A
231	Retainer, Rear Bearing	1	1	1	1	1	1	31904A
231A&231B	Rear Bearing and Lock Pin Kit	1	1	1	1	1	1	KT353
232	Screw, $\frac{5}{16}$ " x $1\frac{1}{2}$ " Hex Head Cap	4	4	4	4	4	4	1736G
233	Crank, Oil Pump Drive	1	1	1	1	1	1	33403A
234	Cap, Bearing Support	--	--	--	--	1	1	**
235	Pin, $\frac{1}{4}$ " x 1" Dowel	--	--	--	--	2	2	13162X **
236	Bolt, $\frac{1}{2}$ " x $1\frac{3}{4}$ " Machine	--	--	--	--	4	4	2796EL **
237	Bearing, Upper Right Half or Lower Left Half	--	--	--	--	2	2	33508A
238	Bearing, Upper Left Half or Lower Right Half	--	--	--	--	2	2	33508B
240	Pin, Threaded Taper	--	--	--	--	1	1	33497A
241	Case, Bearing Support	--	--	--	--	1	1	**
242	Washer, $\frac{1}{2}$ " Spring Lock	--	--	--	--	4	4	13165F
243	Nut, $\frac{1}{2}$ " Hex	--	--	--	--	4	4	1726E **
244	Nut, $\frac{9}{16}$ " Hex	--	--	--	--	1	1	13253F
246	Key, Crankshaft	1	1	1	1	1	1	33505B
247	Screw, Flywheel Hub	1	1	1	1	1	1	31956A
248	Washer, Flywheel Hub Screw	1	1	1	1	1	1	33495A
249	Gauge, Oil Pressure, 300 PSI	1	1	1	1	1	1	1204E
250	Stedy-Mount®	1	1	1	1	1	1	A17311SS
251	Valve, $\frac{1}{4}$ " Screw End Globe	1	1	1	1	1	1	A11392A
252	Nipple, $\frac{1}{4}$ " x 7" Sch. 80 Pipe	1	1	1	1	1	1	13181M
253	Connector, $\frac{1}{4}$ " MPT x $\frac{1}{4}$ " O.D. Compression	1	1	1	1	1	1	13229D
254	Tee, $\frac{1}{4}$ "	1	1	1	1	1	1	1098B
255	Nipple, $\frac{1}{4}$ " x 2" Sch. 80 Pipe	1	1	1	1	1	1	13181C

NOTES:

* Patents Pending.

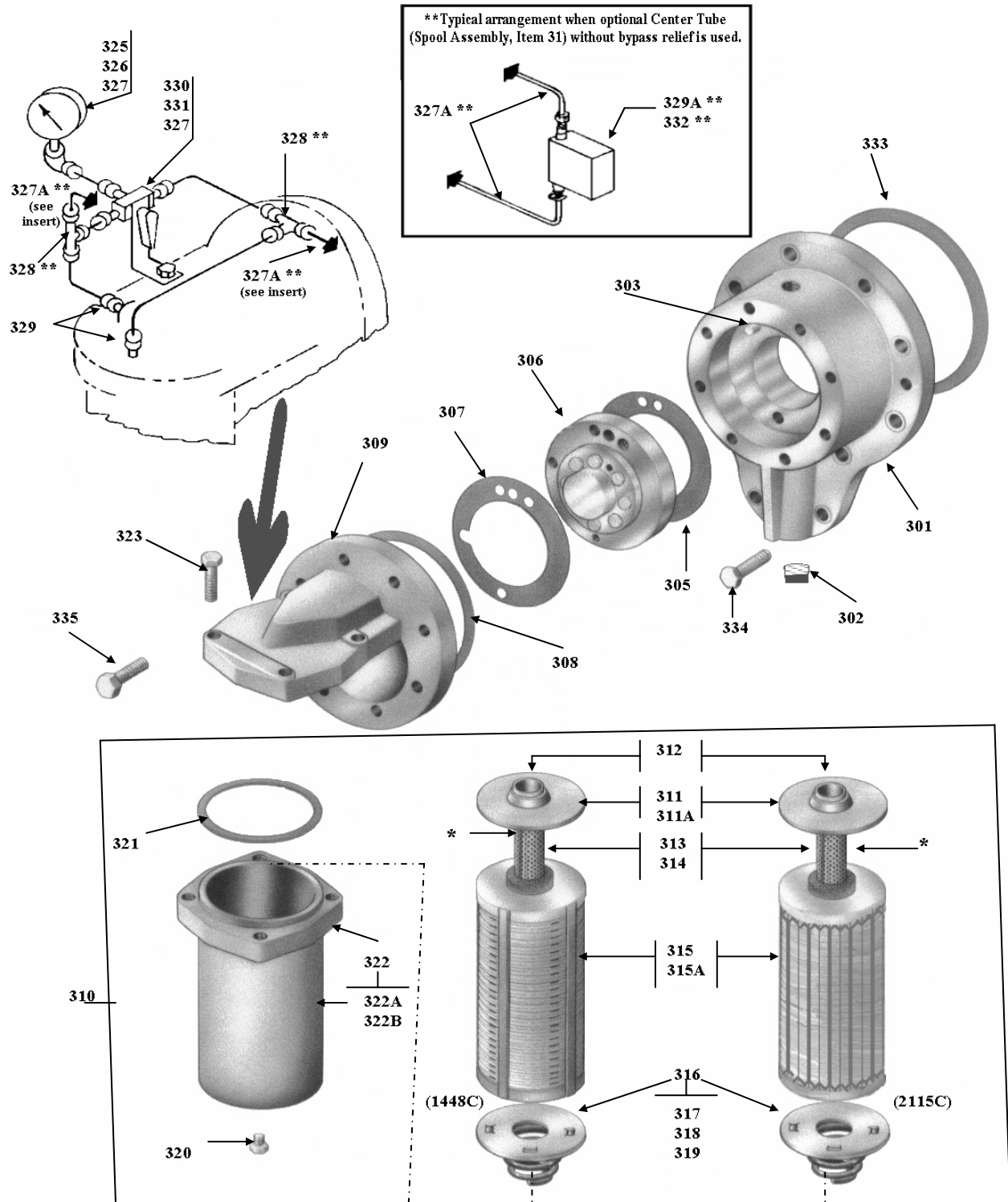
** Matched set with pins, sold as assembly A32163A. Shown in fiveparts to illustrate disassembly.

VILTER MANUFACTURING CORPORATION

450XL® * VMC COMPRESSORS

February 2001
Replaces
May 1985

**REAR BEARING COVER REPLACEMENT PARTS
FIGURE 6**



*** DO NOT DISASSEMBLE CENTER TUBE –
FACTORY PRESET RELIEF VALVE**

February 2001

Replaces

May 1985

VILTER MANUFACTURING CORPORATION

SECTION 100-R

PAGE 13

450XL® * VMC COMPRESSORS**REAR BEARING COVER REPLACEMENT PARTS**

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
301 thru 304 & 333	Rear Bearing Cover Assembly Kit	1	1	1	1	1	1	KT092
301	Cover, Rear Bearing	1	1	1	1	1	1	Order Kit
302	Plug, 3/4" Hex Socket Head Pipe	1	1	1	1	1	1	13163E
303	Pin, 3/8" x 1" Dowel	1	1	1	1	1	1	2868H
304	Orifice, Oil Metering (not shown)	1	1	1	1	1	1	33361A
305	Gasket, Oil Pump Body	1	1	1	1	1	1	31899A
306	Oil Pump Assembly	1	1	1	1	1	1	A33480A
307	Gasket, Oil Pump Cover	1	1	1	1	1	1	31900A
308	Gasket, Oil Pump and Rear Bearing Cover Seal	1	1	1	1	1	1	33320A
309	Cover, Oil Pump and Filter Head (R12 & R502)	1	1	1	1	1	1	34565A
309	Cover, Oil Pump and Filter Head (R717 & R22)	1	1	1	1	1	1	34760AB
310 ***	Filter Assy., Complete (without Bypass Relief)	1	1	1	1	1	1	A35241A
310 **	Filter Assy., Complete (with Bypass Relief)	1	1	1	1	1	1	A35240A
311 ***	Spool Assembly (without Bypass Relief)	1	1	1	1	1	1	2046A
311A,312, 313 & 314	Spool – Strainer Tube Assembly	1	1	1	1	1	1	1448U
311A, 312 Thru 314 & 315A thru 319 & 321	Filter Assembly (without Shell)	1	1	1	1	1	1	1448T
311A **	Spool Assembly (with Bypass Relief)	1	1	1	1	1	1	1448J
312	Seal, Spool End	1	1	1	1	1	1	1448H
313	Strainer Tube	1	1	1	1	1	1	1448K
314	Ring, Retaining	1	1	1	1	1	1	1448L
315 ***	Recharge (for A35241A & 2046A) (w/o Bypass) †	1	1	1	1	1	1	2115C †
315A **	Recharge (for A35240A & 1448J) (with Bypass) †	1	1	1	1	1	1	1448C †
316	Pressure Plate Assembly	1	1	1	1	1	1	1448M
317	Pressure Plate	1	1	1	1	1	1	1448N
318	'O' Ring Seal, Pressure Plate	1	1	1	1	1	1	1448P
319	Spring, Pressure Plate	1	1	1	1	1	1	1448Q
320	Plug, Steel Hexagon Head 1/8" Pipe	1	1	1	1	1	1	13264A
321	Gasket, Oil Filter Head	1	1	1	1	1	1	1448B
322	Filter Shell with Flange and Plug	1	1	1	1	1	1	A34623A
322A	Flange, Oil Filter Tank	1	1	1	1	1	1	35125A
322B	Tank, Oil Filter	1	1	1	1	1	1	34623A
323	Screw, Hexagon Head Cap 7/16" x 2"	4	4	4	4	4	4	1689G
324 ***	Instruction/Nameplate (for use with A35241A) (not shown)	1	1	1	1	1	1	40680AJ
324 **	Instruction/Nameplate (for use with A35240A) (not shown)	1	1	1	1	1	1	40680AT
325	Gauge, 2 1/2", 0-300 PSI, Oil Filter	1	1	1	1	1	1	2047A
326	Elbow, 1/4" 90° Female Compression	1	1	1	1	1	1	1892B
327	Tubing, 1/4" O.D. Steel	3ft	3ft	3ft	3ft	3ft	3ft	S1589AA
327A ***	Tubing, 1/4" O.D. Steel ("AR" – As Required)	AR	AR	AR	AR	AR	AR	S1589AA
328 ***	Tee, 1/4" Compression	2	2	2	2	2	2	13239C
329	Connector, 1/4" MPT x 1/4" O.D. Compression	2	2	2	2	2	2	13229D
329A ***	Connector, 1/4" MPT x 1/4" O.D. Compression	2	2	2	2	2	2	13229D
330	Valve, 3-Way, Oil Filter	1	1	1	1	1	1	2030A
331	Bracket, Valve	1	1	1	1	1	1	35106A
332 ***	Control, Pressure Differential	1	1	1	1	1	1	1643V
333	Gasket, Bearing Cover	1	1	1	1	1	1	31890A
334	Screw, 5/8" x 2" Hexagon Head Cap	10	10	10	10	10	10	13152E
335	Screw, 1/2" x 1 3/4" Hexagon Head Cap	8	8	8	8	8	8	2796EL

NOTES:

* Patents Pending.

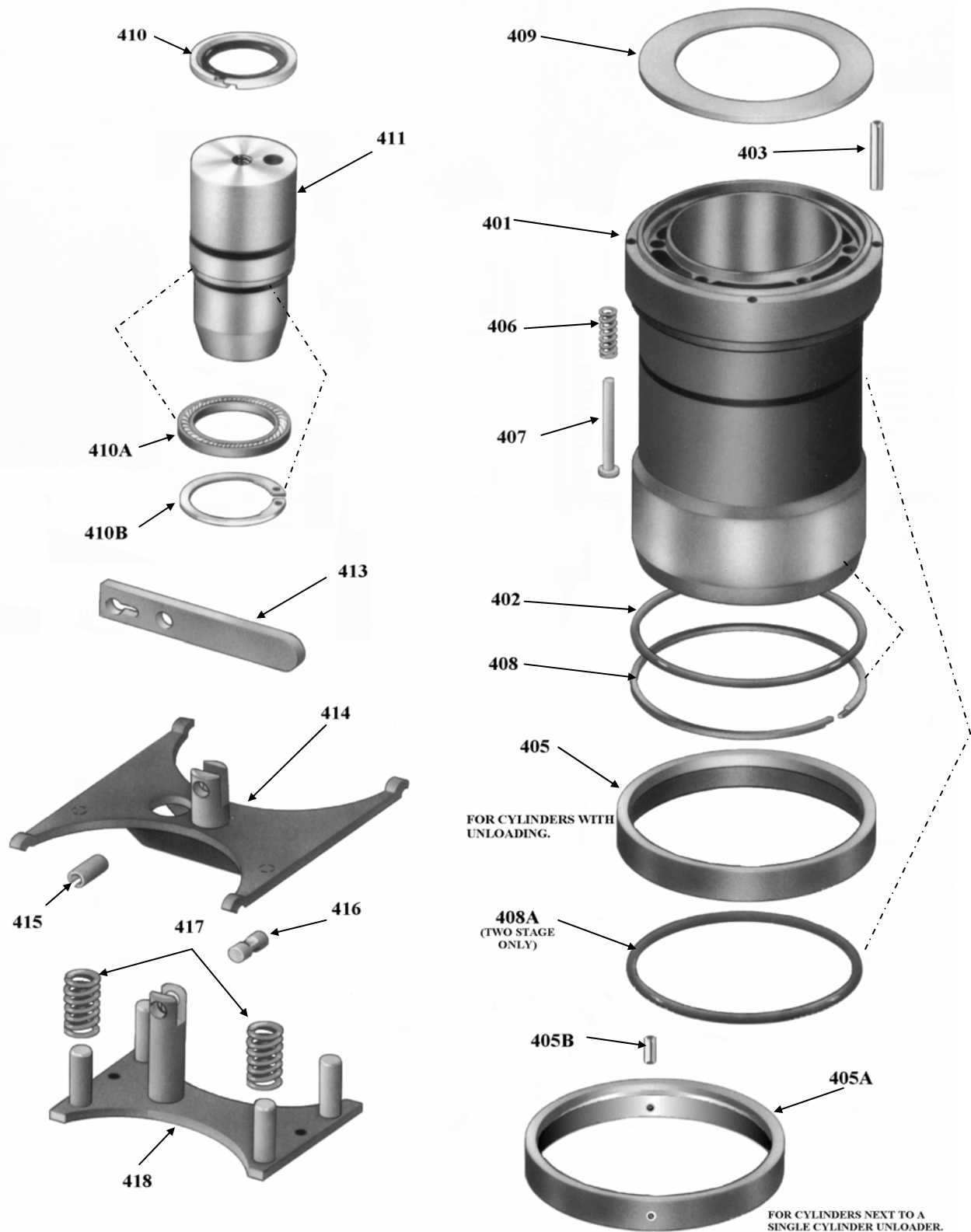
** Filter with bypass relief is standard. These items are used.

*** Filter without bypass relief is optional. When supplied, these items are used.

† Replacement recharge also includes gasket 1448B (Item 321).

450XL® * VMC COMPRESSORS

CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
FIGURE 7



December 2001
Replaces
February 2001

VILTER MANUFACTURING CORPORATION

SECTION 100-R
PAGE 15

450XL® * VMC COMPRESSORS

CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
401, 402 & 403	Cylinder Liner Assembly (for cylinder without unloading)	2(1**)	2	2	4	4	8	KT475
401, 402 Thru 408	Cylinder Liner Assembly (for cylinder with unloading)	-(1**)	2	4	4	8	8	KT476
401A, 402, 403 & 408A	Cylinder Liner Assembly (Two-Stage only) (for cylinder without unloading)	--	--	6(3**)	--	12(6**)	--	A35108D
401A, 402 Thru 408A	Cylinder Liner Assembly (Two-Stage only) (for cylinder with unloading)	--	--	-(3**)	--	-(6**)	--	A35108C
401	Liner, Cylinder	2	4	6	8	12	16	34510A
401A	Liner, Cylinder (Two-Stage only)	--	--	6	--	12	--	34710A
402	Seal, 'O' Ring (upper)	2	4	6	8	12	16	2176BH
403	Pin, Roll, 0.125" dia. x 1½" lg.	8	16	24	32	48	64	1193Q
405	Ring, Lift	-(1**)	2	4(3**)	4	8(6**)	8	35071A
405A +	Ring, Lift	1	2	4	4	8	8	35380A
405B +	Pin, Roll	4	4	4	4	4	4	1193SS
406	Spring, Lift	-(8**)	16	32(24**)	32	64(48**)	64	35069A
407	Pin, Lift	-(8**)	16	32(24**)	32	64(48**)	64	35070A
408	Retainer, Lift Ring	-(1**)	2	4(3**)	4	8(6**)	8	1971A
408A	Seal, 'O' Ring (lower – Two-Stage only)	--	--	6	--	12	--	2176BL
409	Plate, Suction Valve	2	4	6	8	12	16	31909A
410A/B & 411	Piston & Rings Assy., Cap Red (Oil †)	-(1**)	1	2(3**)	2	4(6**)	4	A35315BX
410 & 411	Piston & Rings Assy., Cap Red (Gas †)	-(1**)	1	2(3**)	2	4(6**)	4	A35315CX
410	Ring Set (PTFE & rubber)	-(1**)	1	2(3**)	2	4(6**)	4	2557A
410A	Seal, Unload Piston (Oil only)	1	1	1	1	1	1	2639A
410B	Ring, Retaining Unload Piston (Oil only)	1	1	1	1	1	1	2638A
411	Piston, Unloader (Gas or Oil)	-(1**)	1	2(3**)	2	4(6**)	4	Order Assy
413 thru 420	Complete Capacity Control Mechanism Assembly * (Low Suction R717 and all Booster)	--	1	2	2	4	4	A41788BX
413	Arm, Yoke Lifting	-(1**)	1	2(3**)	2	4(6**)	4	41725A
414	Yoke Assembly (2 Cylinder and Two-Stage only)	-(1**)	--	-(3**)	--	-(6**)	--	A33575A
414	Yoke Assembly	--	1	2	2	4	4	A33335A
415	Pin, 3/8" x 11/16" lg. Roll	-(1**)	1	2(3**)	2	4(6**)	4	1193X
416	Pin, Short Pivot	-(1**)	1	2(3**)	2	4(6**)	4	33250B
417	Spring, Unloader Yoke	-(4**)	4	8(12**)	8	16(24**)	16	33686A
418	Yoke Guide Assembly	--	1	2	2	4	4	A33347A

NOTES:

* Patents Pending.

** Two cylinder high stage and 6 & 12 cylinder Two-Stage Compressor only:

Unloading is NOT standard. When supplied as an option, single cylinder unloading is provided on 50% of the cylinders. These items and quantities in () are then used. Also, for single cylinder unloading, the yoke assembly (Part Number A33575A) and two pins on the Yoke Guide Assembly (Part Number A33576A) have drill and tapped holes to accommodate screw (Item 419) and spacers (Item 420).

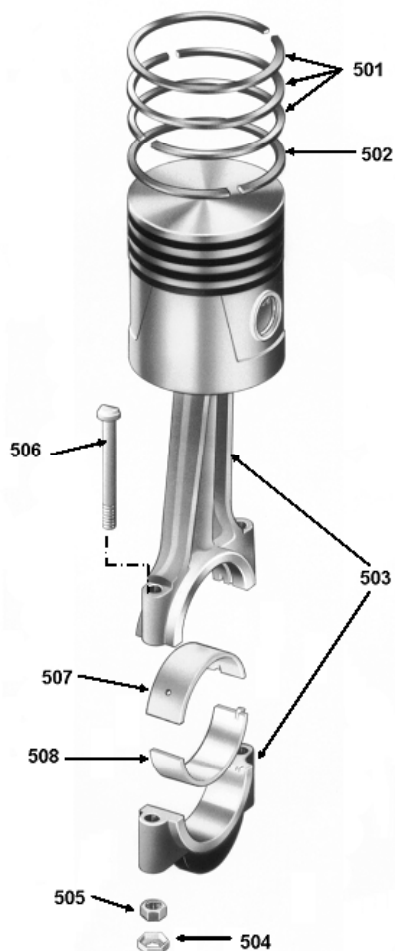
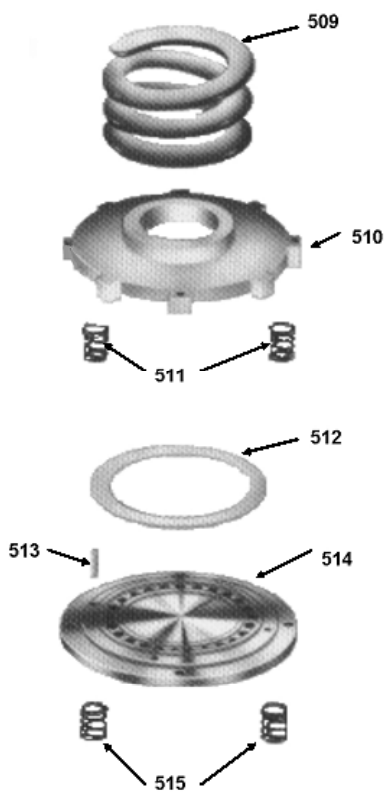
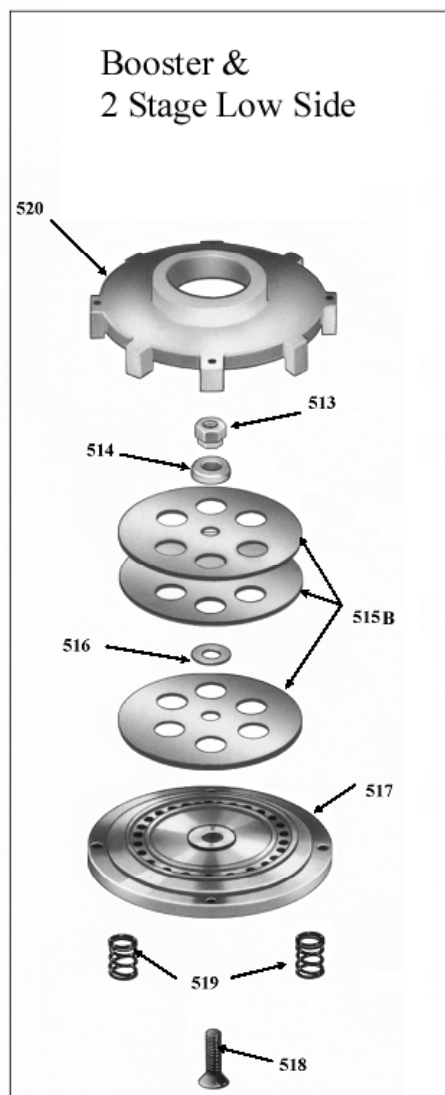
*** Parts quantities are listed for standard unloading only (except 2 cylinder and two-stage, see note **). Standard unloading on compressors with 2 cylinders is none; 4 cylinders is 50%; 6 cylinders is 33 & 66%; 8 cylinders is 25 & 50%; 12 cylinders is 33 & 66%; 16 cylinders is 25 & 50%; and two-stage is none. See Operation Section for other unloading options.

† Actuation type presently on your compressor can be determined by checking unloading solenoid valve – oil uses three-way valves, gas uses two-way valves. Gas unloading was considered standard on all high-stage compressors, except those with 100% capacity reduction. Oil unloading is standard on high-stage compressors with 100% capacity reduction, all boosters and two-stage compressors with capacity reduction.

+ If a single cylinder unloader mechanism serviced uses pivot bolts to hold down one half them mechanism, it should be replaced by 405A and 405B.

450XL® * VMC COMPRESSORS

PISTON AND CONNECTING ROD ASSEMBLY
AND SAFETY HEAD REPLACEMENT PARTS
FIGURE 8



February 2001
Replaces
May 1985

VILTER MANUFACTURING CORPORATION

SECTION 100-R
PAGE 17

450XL® * VMC COMPRESSORS

PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR						PART NUMBER
		NUMBER OF CYLINDERS						
		2	4	6	8	12	16	
501 thru 508	Piston Rings and Connecting Rod Assy Kit	2	4	6	8	12	16	KT573 **
501	Piston Ring, Compression	6	12	18	24	36	48	31989M
502	Piston Ring, Oil	2	4	6	8	12	16	31989N
503	Piston and Connecting Rod Assy	2	4	6	8	12	16	**
504, 507 & 508	Bearing Half and Lock Nut Kit	2	4	6	8	12	16	KT575
504	Lock Nut, ³ / ₈ " , Connecting Rod	4	8	12	16	24	32	2028A
505	Nut, Plain Hex ³ / ₈ "-UNF	4	8	12	16	24	32	2027A
506	Bolt, Connecting Rod	4	8	12	16	24	32	31955A
507	Bearing Half, Connecting Rod (upper)	2	4	6	8	12	16	Order KT575
508	Bearing Half, Connecting Rod (lower)	2	4	6	8	12	16	Order KT575
509	Spring, Safety Head	2	4	6	8	12	16	35252A
510	Safety Head Yoke Kit (includes 4 of item 513)	2	4	6	8	12	16	KT543
520	Booster- Safety Head Yoke	2	4	6	8	12	16	31941B
	2-Stage Low side- Safety Head Yoke	-	-	4	-	8	-	31941B
511	Spring, Valve	16	32	48	64	96	128	33803A
512	Plate, Discharge Valve	2	4	6	8	12	16	35080SS
515B	Valve, Diaphragm Discharge (Booster)	6	12	18	24	36	48	
	2-Stage Low Side	-	-	12	-	24	-	31939B
513 & 514	Safety Hd. & Pins Assy (Std. Ammonia)	2	4	6	8	12	16	A35082A
	Safety Hd. & Pins Assy (2- Stage High Side Comp.)	-	-	2	-	4	-	
	Safety Hd. & Pins Assy (#) (<i>Halo</i>)	2	4	6	8	12	16	A35272A
	Safety Hd. & Pins Assy (2- Stage High Side Comp.)	-	-	2	-	4	-	
513	Pin, Roll, 0.187" dia. x ¹¹ / ₁₆ " lg. †	8	16	24	32	48	64	1712F
514	Safety Head-STD.XL	2	4	6	8	12	16	***
515	Spring, Valve	8	16	24	32	48	64	33803A
513 thru 518	Booster- Safety Head- Ammonia	2	4	6	8	12	16	A32695C
	Booster- Safety Head- <i>Halo</i>	2	4	6	8	12	16	A32695D
	2- Stage Low Side- Safety Head- Ammonia	-	-	4	-	8	-	A32695C
	2- Stage Low Side- Safety Head- <i>Halo</i>	-	-	4	-	8	-	A32695D
519	Spring, Valve (Booster)	8	16	24	32	48	64	
	2- Stage Low Side	-	-	16	-	32	-	33803A

NOTES:

- * Patents Pending.
- ** Piston, wrist pin and connecting rod sold only as a kit.
- *** Shown for disassembly purposes only, order assembly.
- † Install with pin's outside longitudinal seam facing outside diameter of safety head.
- # This Safety Head and Pins Assembly is used on standard Halocarbon and High Suction Pressure Ammonia Compressors. High Suction Pressure Compressors are identified with an 'X' in the serial number. Also used in 2- Stage High Side Halo Compressors.

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
May 1985

450XL® * VMC COMPRESSORS

RECOMMENDED SPARE PARTS LIST

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
118	Valve, Internal Relief	1	1	1	1	1	1	1721C
217 & 218	Rotary Shaft Seal Assembly	1	1	1	1	1	1	KT 509
306	Oil Pump Assembly	1	1	1	1	1	1	A33480A
315	Recharge, Oil Filter (Gasket 1448B included) (for use with 2046A & A35241A) (w/o bypass)	1	1	1	1	1	1	2115C
315	Recharge, Oil Filter (Gasket 1448B included) (for use with A35240A & 1448J) (with bypass)	1	1	1	1	1	1	1448C
401 Thru 404	Cylinder Liner Assembly Kit (for cylinder without unloading) (for cylinder without unloading, Two-Stage)	1 --	1 --	2 1	2 --	2 1	2 --	KT475 A35108D
401 Thru 408	Cylinder Liner Assembly Kit (for cylinder with unloading) (for cylinder with unloading, Two-Stage) **	1 --	1 --	2 1	2 --	2 1	2 --	KT476 A35108C
409	Plate, Suction Plate	2	4	6	8	12	16	31909A
413 Thru 420	Capacity Control Assembly Two Cylinder and Two-Stage Compressor ** 4 thru 16 Cylinder Compressors	1 --	-- 1	1 1	-- 1	1 1	-- 1	A41787AX A41788BX
501 thru 508	Piston, Rings and Connecting Rod Assembly Kit	1	1	2	2	2	2	KT573
501 502	Piston Ring, Compression Piston Ring, Oil	6 2	12 4	18 6	24 8	36 12	48 16	31989M 31989N
504, 507 & 508	Bearing Half and Lock Nut Kit	2	4	6	8	12	16	KT575
511, 515 & 519	Spring, Valve	24	48	72	96	144	192	33803A
512	Plate, Discharge Valve	2	4	6	8	12	16	35080SS
513 & 514	Safety Hd. & Pins Assy (Std. Ammonia) Safety Hd. & Pins Assy (2- Stage High Side Comp.) Safety Hd. & Pins Assy (#) (Halo) Safety Hd. & Pins Assy (2- Stage High Side Comp.)	2 - 2 -	4 - 4 -	6 2 6 2	8 - 8 -	12 4 12 4	16 - 16 -	A35082A A35272A
513 thru 518	Booster- Safety Head- Ammonia Booster- Safety Head- Halo 2- Stage Low Side- Safety Head- Ammonia 2- Stage Low Side- Safety Head- Halo	2 2 - -	4 4 - -	6 6 4 4	8 8 - -	12 12 8 8	16 16 - -	A32695C A32695D A32695C A32695D
---	Gasket Kit, Complete	1	--	--	--	--	--	KT041
---	Gasket Kit, Complete	--	1	--	--	--	--	KT043
---	Gasket Kit, Complete	--	--	1	--	--	--	KT045
---	Gasket Kit, Complete	--	--	--	1	--	--	KT049
---	Gasket Kit, Complete	--	--	--	--	1	--	KT051
---	Gasket Kit, Complete	--	--	--	--	--	1	KT055

NOTES:

A. The above listing includes the minimum selection and quantity of recommended spare parts. All items listed do not necessarily apply to every compressor, because of type, size or optional features. Items should be selected for each individual compressor as they apply.

* Patents Pending.

** When capacity reduction is supplied.

This Safety Head and Pins Assembly is used on standard Halocarbon and High Suction Pressure Ammonia Compressors. High Suction Pressure Compressors are identified with an 'X' in the serial number. Also used in 2- Stage High Side Halo Compressors.

450 VMC COMPRESSORS

(High-Stage, Two-Stage, Booster and Heavy Duty)

REPLACEMENT PARTS LIST

(NOTE: Parts applying only to certain models are indicated throughout the parts list.)

TABLE OF CONTENTS

<u>PAGE</u>	
1	REPLACEMENT PARTS ORDERING INSTRUCTIONS
	BASIC FRAME REPLACEMENT PARTS
2	Illustration, 2 Cylinder (Figure 1)
3	Illustration, 4, 6 & 8 Cylinder (Figure 2)
4	Illustration, 12 & 16 Cylinder (Figure 3)
5	Parts List
	DISCHARGE/SUCTION GAUGE
7	Illustration (Figure 4)
8	Parts List
	CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
9	Illustration (Figure 5)
10	Parts List
	REAR BEARING COVER REPLACEMENT PARTS
12	Illustration (Figure 6)
13	Parts List
	CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
14	Illustration (Figure 7)
15	Parts List
	PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS
16	Illustration (Figure 8)
17	Parts List
	CAPACITY CONTROL MECHANISM REPLACEMENT PARTS
18	Illustration (Figure 9)
18	Parts List
19	RECOMMENDED SPARE PARTS

REPLACEMENT PARTS ORDERING INSTRUCTIONS

1. Give the size and speed of the compressor, as well as serial number and refrigerant used. The serial number is stamped on the nameplate and the compressor frame. The compressor frame serial number location is directly above the suction flange on the frame of the compressor or directly above the rear bearing cover. The rear bearing is located on the oil pump/filter end of the compressor.
2. Always give the name of the part as well as the corresponding part number and/or item number. Also include the number of parts required.
3. Should there be a doubt regarding the part number or name, send a sketch of the part required or return the old part as a sample, transportation charges prepaid. Orders on which part numbers and description do not agree will be filled according to our best interpretation.
4. If parts that appear on the parts list do not appear on the price list, it is because they are sold only as an assembly. All prices shown on the list are F.O.B. factory. Minimum domestic parts order is \$75.00 net price. Prices are for a single item unless otherwise specified in the price list.
5. Please indicate, on the order, preferred method of shipment. We will follow your instructions unless it is to your best interest to change routing.
6. If you purchased the compressor from a party other than Vilter Manufacturing Corporation, please state when you purchased the compressor and from whom.

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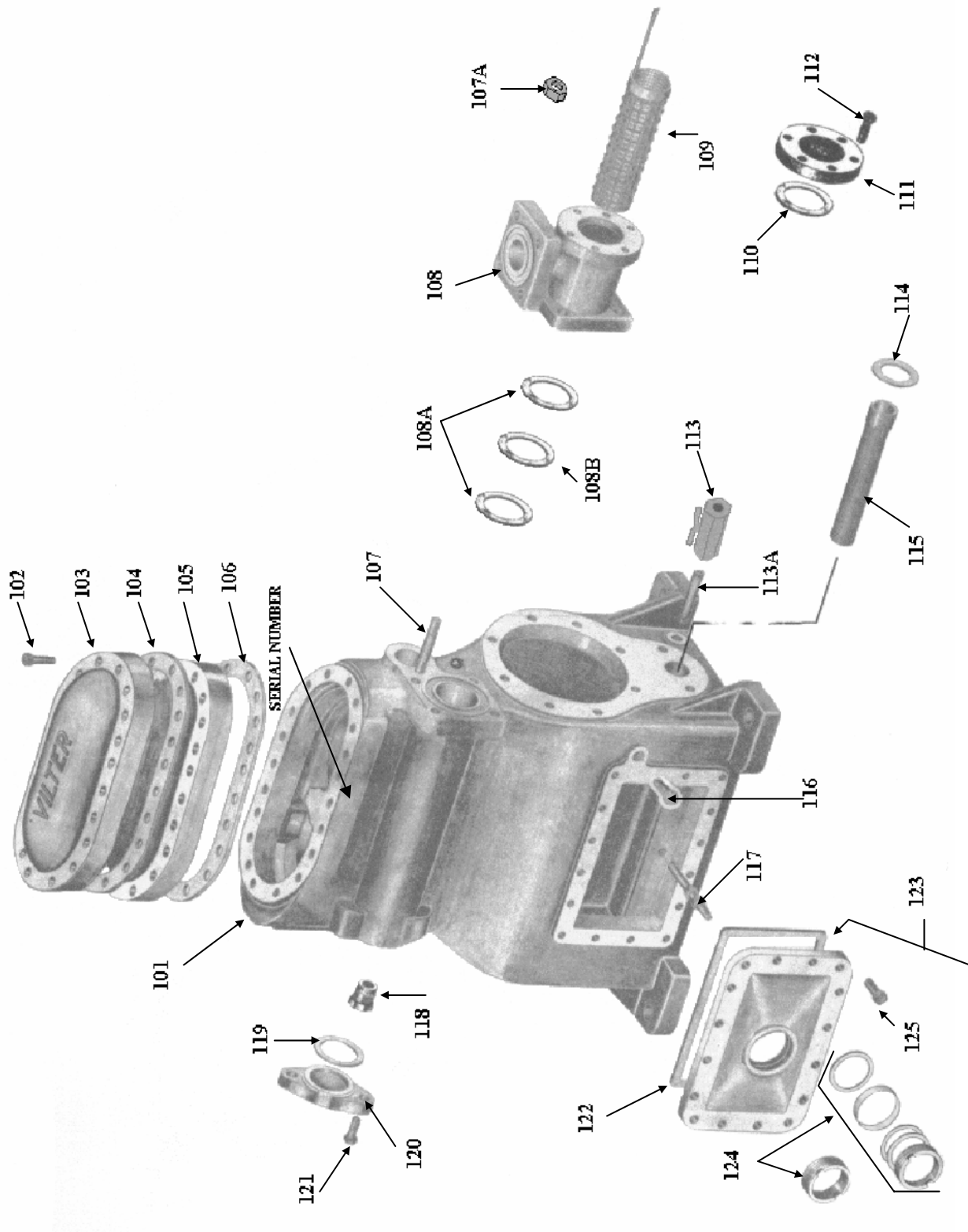
April 1984

450 VMC COMPRESSORS

(High-Stage, Two-Stage, Booster and Heavy Duty)

2 CYLINDER BASIC FRAME REPLACEMENT PARTS

FIGURE 1



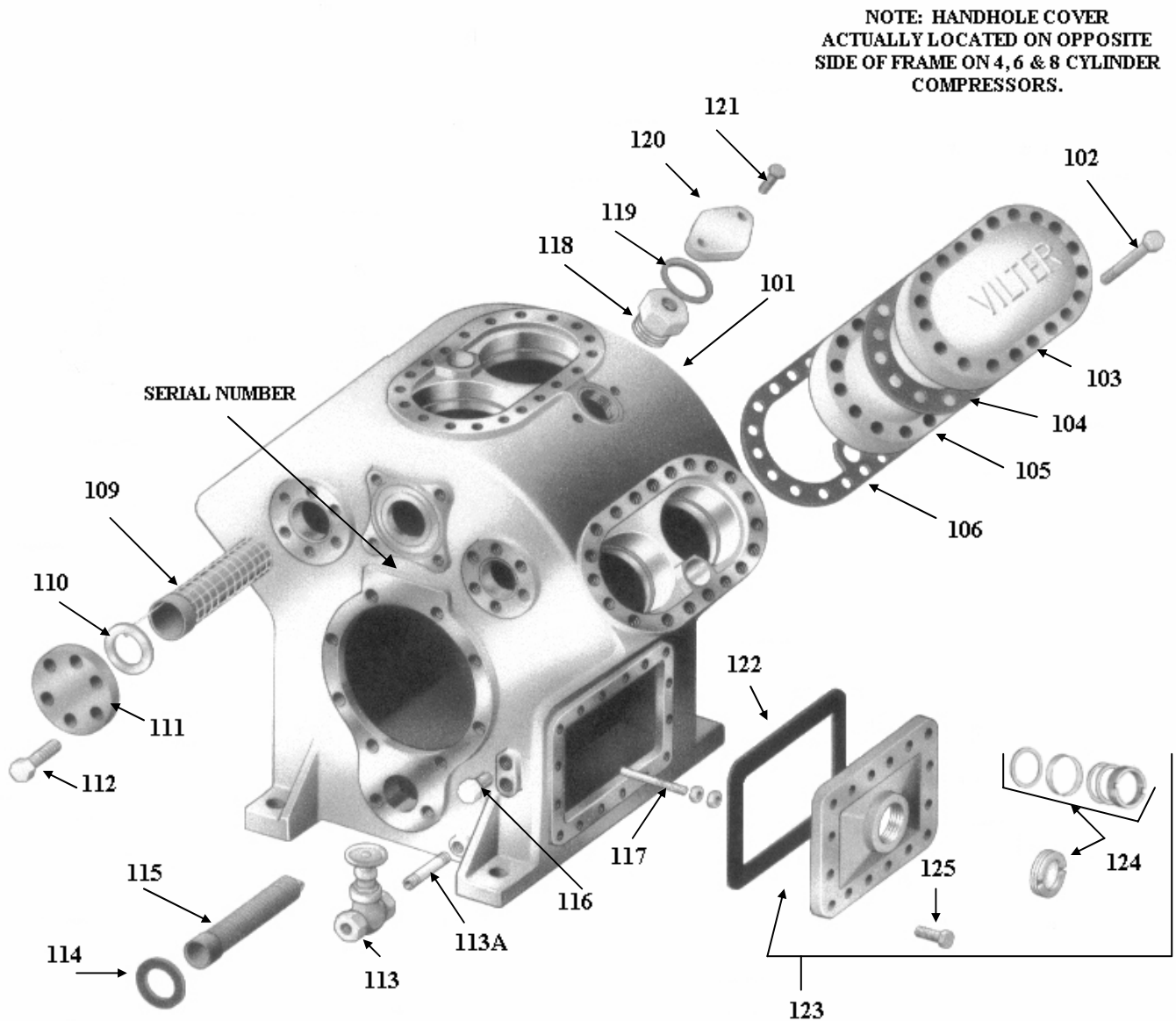
February 2001
Replaces
April 1984

VILTER MANUFACTURING CORPORATION

SECTION 102-R
PAGE 3

450 VMC COMPRESSORS (High-Stage, Two-Stage, Booster and Heavy Duty)

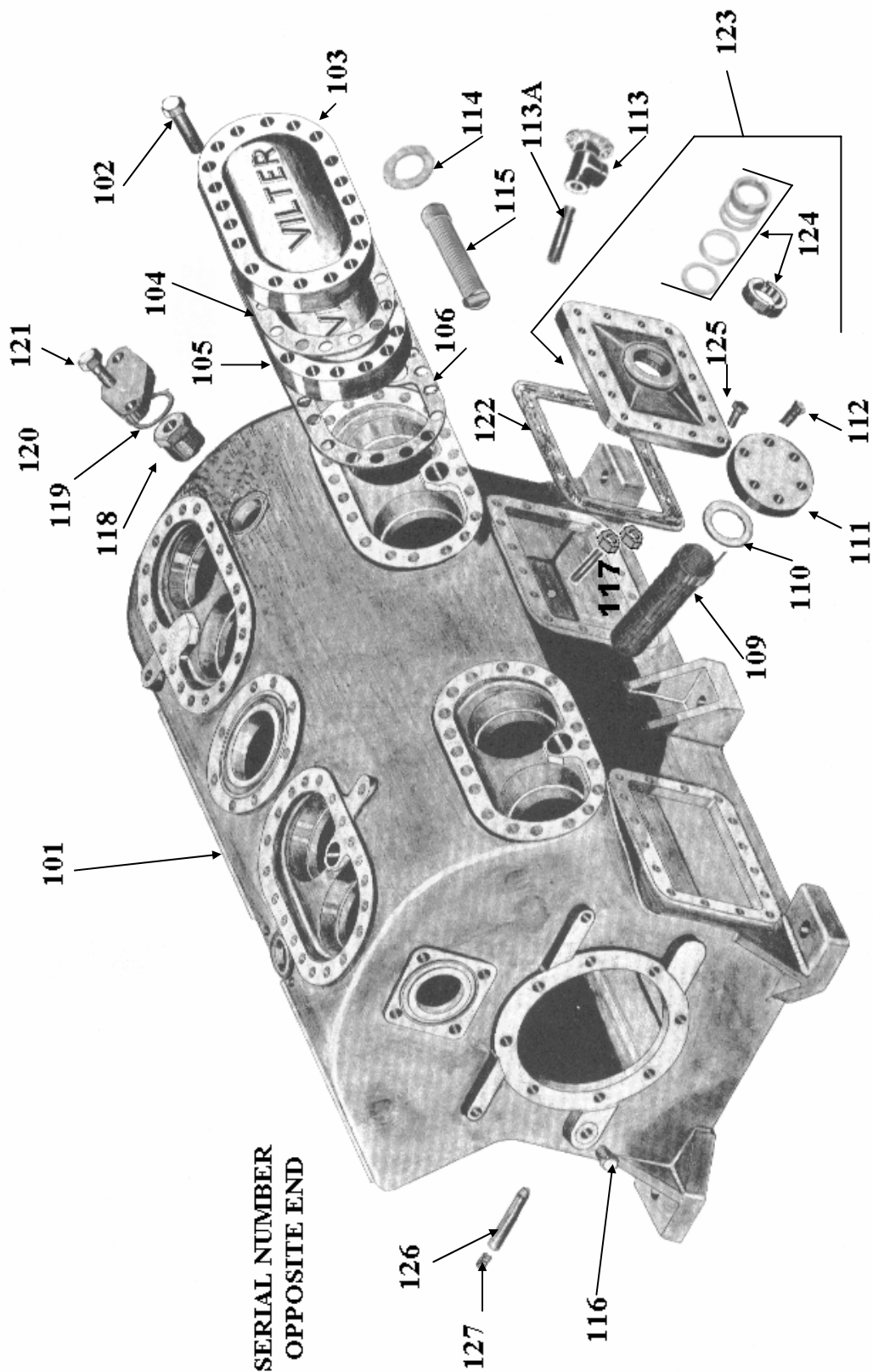
4, 6 AND 8 CYLINDER BASIC FRAME REPLACEMENT PARTS FIGURE 2



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February 2001
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April 1984

450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)
12 AND 16 CYLINDER BASIC FRAME REPLACEMENT PARTS
FIGURE 3



February 2001

Replaces

April 1984

VILTER MANUFACTURING CORPORATION

SECTION 102-R

PAGE 5

450 VMC COMPRESSORS

(High-Stage, Two-Stage, Booster and Heavy Duty)

BASIC FRAME REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
101	Frame	1	1	1	1	1	1	+
102	Screw, $\frac{5}{8}$ " x $3\frac{1}{2}$ " Hex Head Cap (Used with Water Jacket)	20	40	60	80	120	160	13152L
102	Screw, $\frac{7}{8}$ " x $2\frac{1}{2}$ " Hex Head Cap (Used when Water Jacket not used)	20	40	60	80	120	160	13152G
103	Cover, Water Jacket (Ammonia and R22)	1	2	3	4	6	8	30299A
104	Gasket, Water Jacket (Ammonia and R22)	1	2	3	4	6	8	33329A
107 *	Stud, $\frac{5}{8}$ " x 3" (shown only on 2 Cylinder)	8	4	4	4	8	8	13156D
107 *	Stud, $\frac{3}{4}$ " x $3\frac{1}{4}$ " (not shown)	--	4	4	4	--	--	13157D
107 *	Stud, $\frac{3}{4}$ " x $3\frac{3}{4}$ "	--	--	--	--	8	8	13157F
107-A *	Nut, $\frac{5}{8}$ " Hexagon (see Figure 1)	8	4	4	4	8	8	1726G
107-A *	Nut, $\frac{3}{4}$ " Hexagon (see Figure 1)	--	4	4	4	--	--	1726H
108 *	Tee, Suction $2\frac{1}{2}$ " x $2\frac{1}{2}$ " (see Figure 1)	1	--	--	--	--	--	A30319A
108 *	Tee, Suction $3\frac{1}{2}$ "x3" (not shown)	--	1	--	--	--	--	A32417B
108 †	Tee, Suction 5"x4" (not shown)	--	--	--	1	--	--	36254C
108 †	Tee, Suction 4"x4" (not shown) (High Stage)	--	--	1	--	--	--	A36254B
108 †	Tee, Suction 4"x3" (not shown) (Booster)	--	--	1	--	--	--	A36254A
108 †	Tee, Suction 5"x4" (not shown)	--	--	--	1	--	--	A36254C
108 †	Elbow, Suction 4" (not shown)	--	--	1	--	--	--	12273C
108-A *	Gasket, 4" Flange (Suction/Discharge Conn)	--	--	2	2	--	--	11323L
108-A *	Gasket, $2\frac{1}{2}$ " Flange (Suction/Discharge Conn)	1	2	--	--	--	--	11323H
108-A *	Gasket, $3\frac{1}{2}$ " Flange (Suction/Discharge Conn)	--	1	--	--	--	--	11323K
108-A *	Gasket, 3" Flange (Suction/Discharge Conn)	--	--	3	--	--	--	11323J
108-A *	Gasket, 5" Flange (Suction/Discharge Conn)	--	--	--	--	1	1	11323M
108-B *	Ring, Male Joint 4" (Suction)	--	--	1	--	--	--	13151L
109 †	Suction Screen	1	--	2	2	--	--	A32428D
109	Suction Screen	--	1	--	--	--	--	A32428A
109 †	Suction Screen (Center)	--	--	--	1	--	--	A32428C
109 †	Suction Screen (RH Side, 75% Cap Red)	--	--	--	1	--	--	A32428D
109 †	Suction Screen	--	--	1	1	--	--	A35215A
109	Suction Screen	--	--	--	--	2	2	A32565A
109-A *	Bag, Suction Screen (not shown)	--	1	--	--	--	--	A33474A
109-A †	Bag, Suction Screen (not shown)	1	--	2	3	--	--	A33474B
109-A *	Bag, Suction Screen (not shown)	--	--	--	--	2	2	A33474G
109-A †	Bag, Suction Screen (not shown)	--	--	1	1	--	--	A35234A
110	Gasket, Suction Screen Cover	1	--	2	2	--	--	31892A
110	Gasket, Suction Screen Cover	--	--	--	--	2	2	33493A
110 †	Gasket, Suction Tee Cover	--	1	--	1	--	--	11323J
110 †	Gasket, Suction Tee Cover	--	--	1	1	--	--	35217A
111	Cover, Suction Screen	1	--	2	2	--	--	31893A
111	Cover, Suction Screen	--	--	--	--	2	2	33492A
111 †	Cover, Suction Tee (VPN 32417 & 36254C)	--	1	--	1	--	--	13706A
111 †	Cover, Suction Tee (VPN 36254)	--	--	1	1	--	--	35216A
112	Screw, $\frac{7}{8}$ " x $1\frac{1}{2}$ " Hex Head Cap	--	5	--	5	--	--	13152C
112	Screw, $\frac{5}{8}$ " x $1\frac{3}{4}$ " Hex Head Cap	--	--	6	6	--	--	13152D
112	Screw, $\frac{1}{2}$ " x $1\frac{1}{2}$ " Hex Head Cap	6	--	12	12	16	16	2796E
113	Valve, $\frac{1}{2}$ " Oil Charge and Drain	1	1	1	1	1	1	A15375A
113-A	Nipple, $\frac{1}{2}$ "x4" Sch. 80 Pipe	1	1	1	1	1	1	13189G
114	Gasket, Crankcase Oil Screen	1	1	1	1	1	1	31889A
115	Crankcase Oil Screen Assembly	1	1	1	1	1	1	A31886A
116	Plug, $\frac{3}{4}$ " Hex Head Pipe (not shown on 12)	1	1	1	1	1	1	13264E
116	Plug, $\frac{1}{2}$ " Hex Head Pipe (not shown on 2 thru 8)	1	1	1	1	1	1	13264D

NOTES:

* May not be shown, or only shown typically on one illustration.

+ Part Number on application

† 6 Cylinder Compressors with serial numbers below 45461 (oil unloading) and 60019 (gas unloading) are equipped with a suction elbow and two suction screens (VPN A32428B) located behind the suction screen covers on the frame. 6 Cylinder compressors with serial numbers 45461 (oil unloading) and 60019 (gas unloading) and above are equipped with a suction tee (VPN 36254) and a single suction screen (VPN A35215A) located in the suction tee. 8 Cylinder compressors with serial numbers below 45461 (oil unloading) and 60019 (gas unloading) are equipped with a suction tee (VPN 36254C) and three suction screens, one in the tee and two behind the suction screen covers on the frame. 8 Cylinder compressors with serial numbers 45461 (oil unloading) and 60019 (gas unloading) and above are equipped with suction tee (VPN 36254) and a single suction screen (VPN A35215A) located in the suction tee.

†† Part Number on application.

VILTER MANUFACTURING CORPORATION

February 2001

Replaces

April 1984

450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

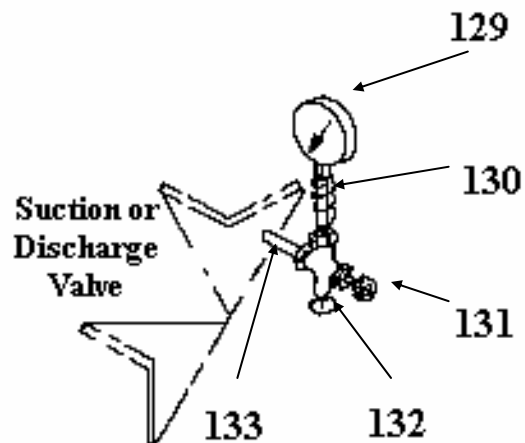
BASIC FRAME REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
117	Pin Assembly, Crankcase Oil Screen Retaining	1	1	1	1	1	1	A31936A
118	Safety Valve (Internal Relief)	1	1	1	1	2	2	1721B
119	Gasket, 2" Flange	3	1	1	1	2	2	11323G
120	Cover, Safety Valve	1	1	1	1	2	2	31954A
121	Screw, $\frac{5}{8}$ " x 2" Hex Head Cap	2	2	2	2	4	4	13152E
122	Gasket, Handhole Cover	1	1	1	1	2	2	31894A
123	Handhole Cover and Sight Glass Assy (Std Conn)	1	1	1	1	2	2	A33034L
124	Glass, Oil Sight - 2"	1	1	1	1	2	2	1484A
125	Screw, $\frac{1}{2}$ " x $1\frac{1}{2}$ " Hex Head Cap	16	16	16	16	32	32	2796E
126	Tube, Oil Feed Connector	--	--	--	--	1	1	33494A
127	Spring	--	--	--	--	1	1	31789A

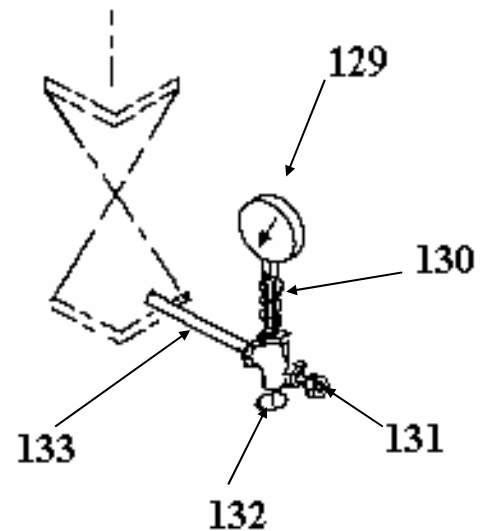
450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

DISCHARGE / SUCTION GAUGE REPLACEMENT PARTS
FIGURE 4

**USED ON 2 THRU 4
CYLINDER
COMPRESSORS**



**USED ON 12 AND
16 CYLINDER
COMPRESSORS**



VILTER MANUFACTURING CORPORATION

February 2001
Original Issue

450XL® * VMC COMPRESSORS

DISCHARGE / SUCTION GAUGE REPLACEMENT PARTS

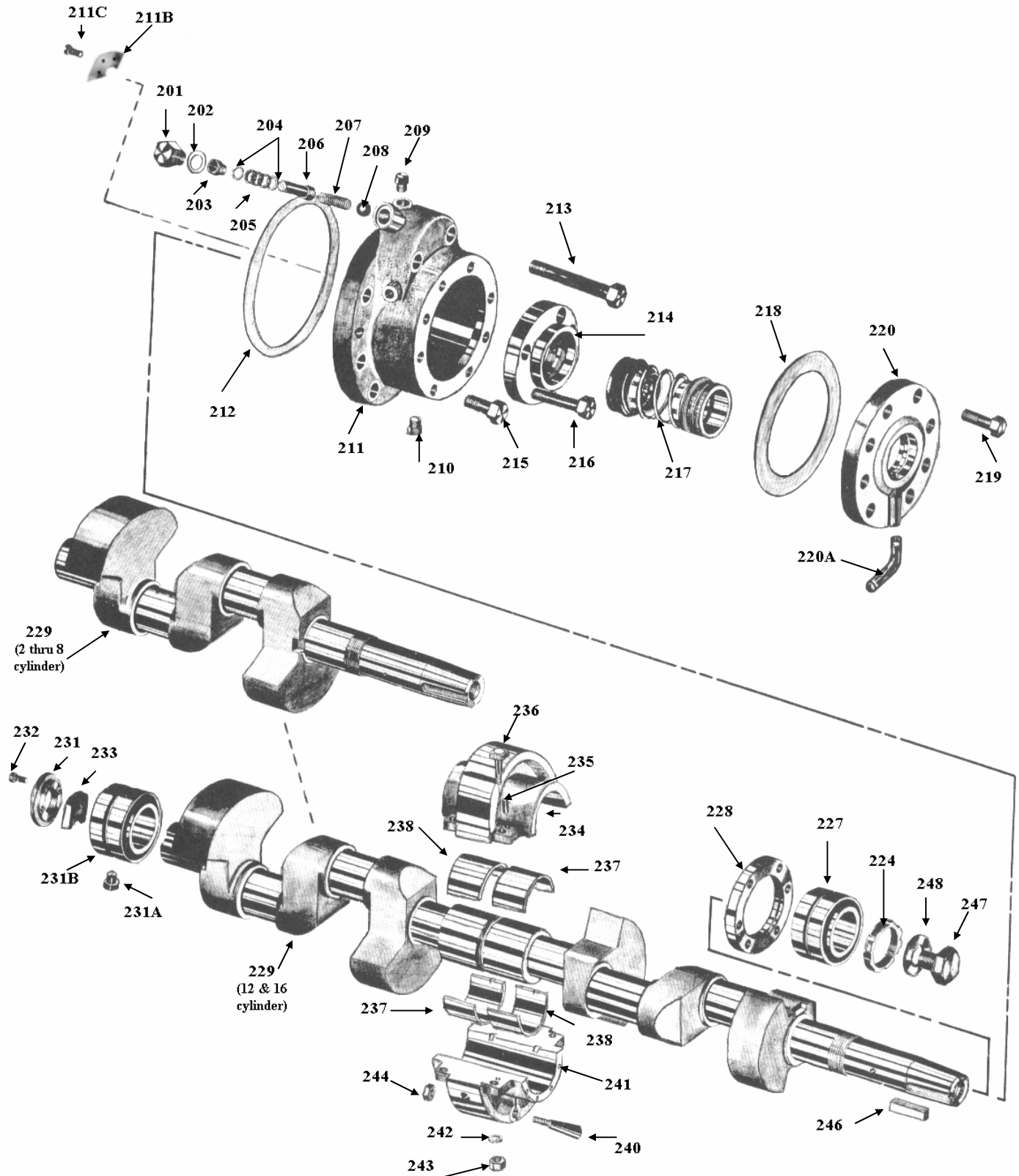
ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
128	Heater, Electric Crankcase Oil, 115V (not shown)	1	1	1	1	2	2	2069J
128	Heater, Electric Crankcase Oil, 230V (not shown)	1	1	1	1	2	2	2069K
129	Gauge, Discharge, 300 PSI	1	1	1	1	2	2	1204E
129	Gauge, Suction, 150 PSI	1	1	1	1	1	1	1204C
130	Stedy-Mount®	2	2	2	2	3	3	A17311SS
131	Connector, ¼" MPT x ¼" O.D. Compression	2	2	2	2	3	3	13229D
133	Nipple ¼" x 4" Sch. 80 Pipe	2	2	2	2	3	3	13181G
134	Thermometer, Crankcase Oil (not shown)	1	1	1	1	1	1	1467F

February 2001
Replaces
April 1984

VILTER MANUFACTURING CORPORATION
450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

SECTION 102-R
PAGE 9

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
FIGURE 5



450 VMC COMPRESSORS

(High-Stage, Two-Stage, Booster and Heavy Duty)

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
201 thru 211A	Front Bearing Cover & Relief Valve Assy	1	1	--	--	--	--	A31121A
	Front Bearing Cover & Relief Valve Assy	--	--	1	1	1	1	A32566A
201 thru 233	Complete Crankshaft Sub-Assembly Kit	1	--	--	--	--	--	KT445
	Complete Crankshaft Sub-Assembly Kit	--	1	--	--	--	--	KT446
	Complete Crankshaft Sub-Assembly Kit	--	--	1	--	--	--	KT447
	Complete Crankshaft Sub-Assembly Kit	--	--	--	1	--	--	KT448
	Complete Crankshaft Sub-Assembly Kit (HD)	--	--	--	1	--	--	KT553
	Complete Crankshaft Sub-Assembly Kit	--	--	--	--	1	--	KT449
201 thru 244 less *	Complete Crankshaft Sub-Assy Kit (Hi-Stage HD)	--	--	--	--	--	1	KT554
	Complete Crankshaft Sub-Assy Kit (Booster)	--	--	--	--	--	1	KT555
201	Cap, Valve	1	1	1	1	1	1	17355A
202	Gasket, Durabla	1	1	1	1	1	1	30651C
203	Nut, Packing	1	1	1	1	1	1	31048A
204	Washers	2	2	2	2	2	2	31048D
205	Packing, $\frac{7}{8}$ " O.D. x $\frac{39}{64}$ " I.D. x $\frac{3}{8}$ "	1	1	1	1	1	1	31048E
206	Stem, Valve	1	1	1	1	1	1	31048C
207	Spring	1	1	1	1	1	1	31048F
208	Ball, $\frac{5}{8}$ " dia. Steel	1	1	1	1	1	1	13155K
209 thru 211A	Front Bearing Cover Assembly	1	1	--	--	--	--	A36240A
	Front Bearing Cover Assembly	--	--	1	1	1	1	A36241A
209	Plug, $\frac{1}{4}$ " Hex Head Pipe	1	1	1	1	1	1	13264B
210	Plug, $\frac{3}{8}$ " Hex Head Pipe	1	1	1	1	1	1	13264C
211	Cover, Front Bearing	1	1	1	1	1	1	Order Assy.
211A +	Orifice, Oil Metering	1	1	1	1	1	1	33361A +
211B	Shield, Splash	1	1	1	1	1	1	35274A
211C	Screw, Round Head, No. 10-32 x $\frac{3}{8}$ " long	3	3	3	3	3	3	1332C
212	Gasket, Bearing Cover	1	1	1	1	1	1	31890A
213	Screw, $\frac{5}{8}$ " x 4" Hex Socket Head Cap	2	2	2	2	2	2	13159E
214+	Retainer, Front Bearing (with Oil Hole)	1	1	--	--	--	--	31885A +
214+	Retainer, Front Bearing (with Oil Hole)	--	--	1	1	1	1	33500A +
215	Screw, $\frac{5}{8}$ " x 2" Hex Head Cap	6	6	6	6	6	6	13152E
216	Screw, $\frac{1}{2}$ " x 4" Hex Head Cap	3	3	3	3	3	3	2796EV
217	Seal, Rotary Shaft Assembly	1	1	--	--	--	--	A33483A
217	Seal, Rotary Shaft Assembly	--	--	1	1	1	1	A33489A
218	Gasket, Shaft Seal Cover	1	1	--	--	--	--	31897A
218	Gasket, Shaft Seal Cover	--	--	1	1	1	1	33496A
219	Screw, $\frac{1}{2}$ " x 1 $\frac{1}{4}$ " Hex Head Cap	8	8	8	8	8	8	2796EL
220 & 220A	Cover, Shaft Seal, Small	1	1	--	--	--	--	31044A
220 & 220A	Cover, Shaft Seal, Large	--	--	1	1	1	1	A32564A
220A	Drain Tube	1	1	1	1	1	1	35078A
224	Crankshaft and Bearings Assembly	1	--	--	--	--	--	A34554A
Thru	Crankshaft and Bearings Assembly	--	1	--	--	--	--	A34554B
233	Crankshaft and Bearings Assembly	--	--	1	--	--	--	A34555A
	Crankshaft and Bearings Assembly	--	--	--	1	--	--	A34555B
	Crankshaft and Bearings Assembly (HD)	--	--	--	1	--	--	A34555BX
	Crankshaft and Bearings Assembly Kit	--	--	--	--	1	--	KT556
	Crankshaft and Bearings Assy Kit (High Stage HD)	--	--	--	--	--	1	KT557
	Crankshaft and Bearings Assy Kit (Booster)	--	--	--	--	--	1	KT558
224	Locknut and Retaining Compound Kit	1	1	--	--	--	--	KT366
224	Locknut and Retaining Compound Kit	--	--	1	1	1	1	KT367
227	Front Bearing and Retaining Compound Kit	1	1	--	--	--	--	KT368
227	Front Bearing and Retaining Compound Kit	--	--	1	1	1	1	KT369
228	Ring, Front Bearing Retainer	1	1	--	--	--	--	33144A
228	Ring, Front Bearing Retainer	--	--	1	--	1	--	33145A
228	Ring, Front Bearing Retainer	--	--	--	1	--	1	34564A

NOTES:

* Less items 234, 235, 236, 239 and 241.

+ See note with same symbol on Page 9.

February 2001
Replaces
April 1984

VILTER MANUFACTURING CORPORATION
450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

SECTION 102-R
PAGE 11

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
229	Crankshaft & Retaining Compound Kit	1	--	--	--	--	--	KT377
229	Crankshaft & Retaining Compound Kit	--	1	--	--	--	--	KT378
229	Crankshaft & Retaining Compound Kit	--	--	1	--	--	--	KT379
229	Crankshaft & Retaining Compound Kit	--	--	--	1	--	--	KT380
229	Crankshaft & Retaining Compound Kit (HD)	--	--	--	1	--	--	KT559
229	Crankshaft & Retaining Compound Kit	--	--	--	--	1	--	KT381
229	Crankshaft & Retaining Compound Kit (H/S HD)	--	--	--	--	--	1	KT560
229	Crankshaft & Retaining Compound Kit (Booster)	--	--	--	--	--	1	KT561
229-A	Plug, Pipe, 1/8", Hex Socket Head (not shown)	5	5	5	5	8	8	13163A
231	Retainer, Rear Bearing	1	1	1	1	1	1	31904A
231A&231B	Rear Bearing and Lock Pin Kit	1	1	1	1	1	1	KT353
231-A	Pin, Bearing Lock	1	1	1	1	1	1	33678A
231-B	Bearing, Rear	1	1	1	1	1	1	A33509A
232	Screw, 5/16" x 1 1/2" Hex Head Cap	4	4	4	4	4	4	1736G
233	Crank, Oil Pump Drive	1	1	1	1	1	1	33403A
234	Cap, Bearing Support	--	--	--	--	1	1	*
235	Pin, 1/4" x 1" Dowel	--	--	--	--	2	2	13162X *
236	Bolt, 1/2" x 1 3/4" Machine	--	--	--	--	4	4	2796EL
237	Bearing, Upper Right Half or Lower Left Half	--	--	--	--	2	2	33508A
238	Bearing, Upper Left Half or Lower Right Half	--	--	--	--	2	2	33508B
239 †	Dam, Center Bearing Oil	--	--	--	--	2	2	33498A †
240	Pin, Threaded Taper	--	--	--	--	1	1	33497A
241	Case, Bearing Support	--	--	--	--	1	1	*
242	Washer, 1/2" Spring Lock	--	--	--	--	4	4	13165F
243	Nut, 1/2" Hex	--	--	--	--	4	4	1726E
244	Nut, 9/16" Hex	--	--	--	--	1	1	13253F
245 †	Screw, 1/4" x 1/2" Hex Head Cap	--	--	--	--	8	8	2796AC †
246	Key, Crankshaft	1	1	--	--	--	--	31994B
246	Key, Crankshaft	--	--	1	1	1	1	33505B
247	Screw, Flywheel Hub	1	1	1	1	1	1	31956A
248	Washer, Flywheel Hub Screw	--	--	1	1	1	1	33495A
249	Gauge, Oil Pressure, 300 PSI	1	1	1	1	1	1	1204E
250	Steady-Mount®	1	1	1	1	1	1	A17311SS
251	Valve, 1/4" Screw End Globe	1	1	1	1	1	1	A11392A
252	Nipple, 1/4" x 7" Sch. 80 Pipe	1	1	1	1	1	1	13181M
253	Connector, 1/4" MPT x 1/4" O.D. Compression	1	1	1	1	1	1	13229D
254	Tee, 1/4"	1	1	1	1	1	1	1098B
255	Nipple, 1/4" x 2" Sch. 80 Pipe	1	1	1	1	1	1	13181C

NOTES:

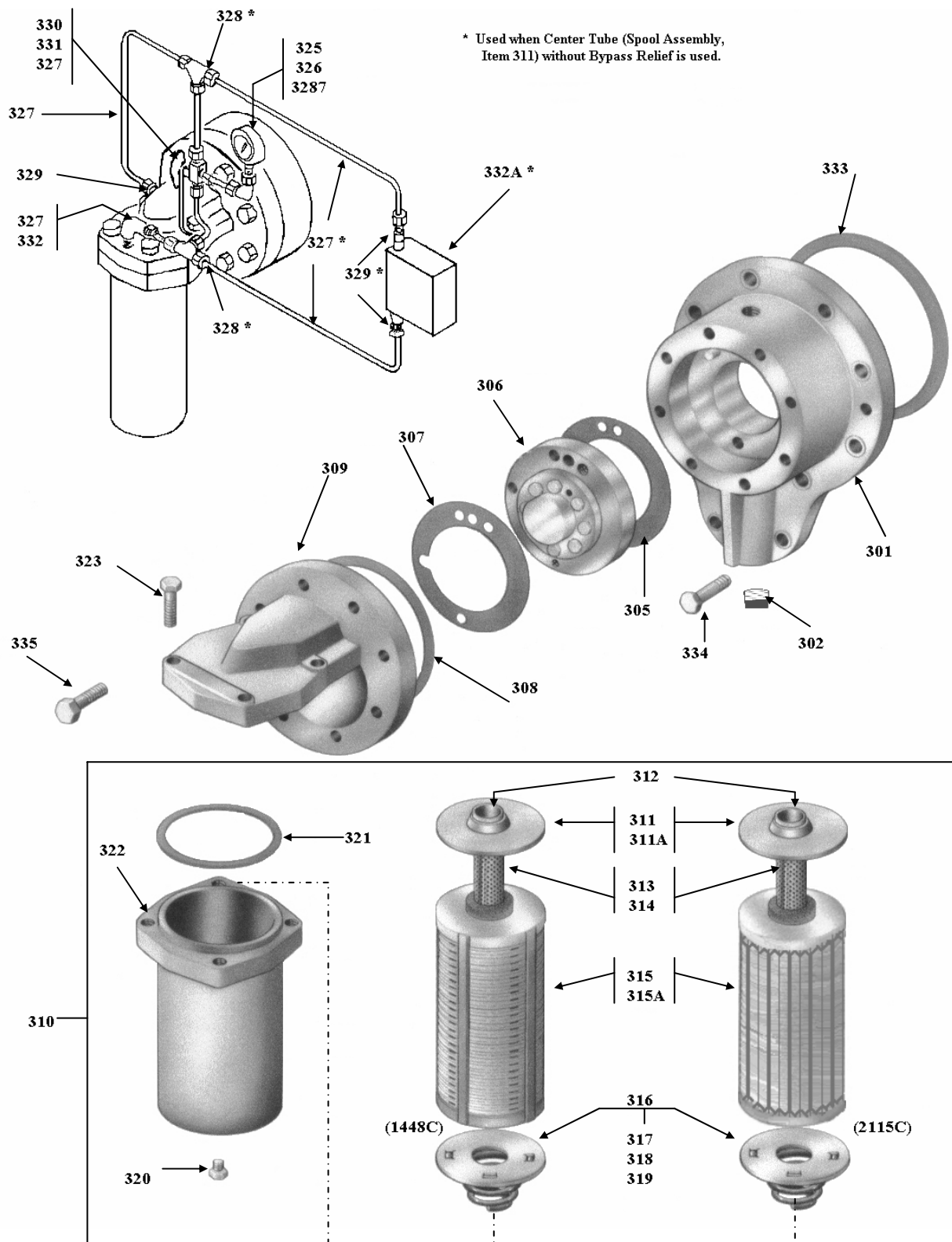
- * Matched set with pins, sold as assembly A32163A. Shown in three parts to illustrate disassembly.
- + See Page 8 for symbol regarding this information. Compressors below serial number 45330 were furnished with the no longer available front bearing cover assemblies A30294A (2 and 4 cylinders) or A32162A (6,8 and 12 cylinders), and front bearing retainer 31885A (2 and 4 cylinders) or 33500A (6, 8 and 12 cylinders) without oil hole. Former front bearing retainers (31885A or 33500A) without oil holes cannot be used with current front bearing cover assemblies A36240A (2 and 4 cylinders) and A36241A (6, 8 and 12 cylinders), as there is no way for oil to get to the bearing. If front bearing cover is being replaced, a current front bearing retainer (31885A or 33500A with oil hole) must be ordered also, unless one of these current styles is already being used. If a current front bearing retainer, (31885A or 33500A, both with oil hole) is used with former style cover (A30294A or A32162A) having an oil hole, remove orifice in cover (A30294A or A32162A) and replace with solid 1/8" pipe plug.
- † Dams (Item 239) and screws (Item 245) are not needed when using VILTER's patented joined crankshafts. In this design version (introduced in 1980), two 6 cylinder or two 8 cylinder crankshafts are joined by a sleeve to form an inseparable 12 cylinder or 16 cylinder crankshaft. This specially machined sleeve eliminates the dams. This design is completely interchangeable with the former design.

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
April 1984

450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

REAR BEARING COVER REPLACEMENT PARTS
FIGURE 6



February 2001
Replaces
March 1984

VILTER MANUFACTURING CORPORATION
450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

SECTION 102-R
PAGE 13

REAR BEARING COVER REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
301 thru 304	Rear Bearing Cover Assembly Kit	1	1	1	1	1	1	KT092
301	Cover, Rear Bearing	1	1	1	1	1	1	Order Kit
302	Plug, 3/4" Hex Socket Head Pipe	1	1	1	1	1	1	13163E
303	Pin, 3/8" x 1" Dowel (not shown)	1	1	1	1	1	1	2868H
304	Orifice, Oil Metering (not shown)	1	1	1	1	1	1	33361A
305	Gasket, Oil Pump Body	1	1	1	1	1	1	31899A
306	Oil Pump Assembly	1	1	1	1	1	1	A33480A
307	Gasket, Oil Pump Cover	1	1	1	1	1	1	31900A
308	Gasket, Oil Pump and Rear Bearing Cover Seal	1	1	1	1	1	1	33320A
309	Cover, Oil Pump and Filter Head	1	1	1	1	1	1	34565A
310	Filter Assy., Complete (without Bypass Relief)	1	1	1	1	1	1	A35241A
310 *	Filter Assy., Complete (with Bypass Relief)	1	1	1	1	1	1	A35240A
311	Spool Assembly (without Bypass Relief)	1	1	1	1	1	1	2046A
311A,312, 313 & 314	Spool – Strainer Tube Assembly	1	1	1	1	1	1	1448U
311A,312 Thru 314 & 315A thru 319	Filter Assembly (without Shell)	1	1	1	1	1	1	1448T
311A *	Spool Assembly (with Bypass Relief) (used on 1448C)	1	1	1	1	1	1	1448J
312	Seal, Spool End	1	1	1	1	1	1	1448H
313	Strainer Tube	1	1	1	1	1	1	1448K
314	Ring, Retaining	1	1	1	1	1	1	1448L
315	Recharge (for use with 2046A and A35241A) †	1	1	1	1	1	1	2115C
315A *	Recharge (for use with A35240A and 1448J) †	1	1	1	1	1	1	1448C
316	Pressure Plate Assembly	1	1	1	1	1	1	1448M
317	Pressure Plate	1	1	1	1	1	1	1448N
318	'O' Ring Seal, Pressure Plate	1	1	1	1	1	1	1448P
319	Spring, Pressure Plate	1	1	1	1	1	1	1448Q
320	Plug, Steel Square Head Pipe 1/8"	1	1	1	1	1	1	1190A
321	Gasket, Oil Filter Head	1	1	1	1	1	1	1448B
322	Filter Shell with Bolt Ring	1	1	1	1	1	1	A34623A
323	Screw, Hex Head Cap 7/16" x 2"	4	4	4	4	4	4	1689G
324	Instruction/Nameplate (for use with A35241A)	1	1	1	1	1	1	40680AJ
324 *	Instruction/Nameplate (for use with A35240A)	1	1	1	1	1	1	40680AT
325	Gauge, 2 1/2", 0-300 PSI, Oil filter	1	1	1	1	1	1	2047A
326	Elbow, 1/4" 90° Female Compression	1	1	1	1	1	1	1892B
327	Tubing, 1/4" O.D. Steel ("AR" = As Required)	AR	AR	AR	AR	AR	AR	S1589A
328 **	Tee, 1/4" Compression	2	2	2	2	2	2	13239C **
329 **	Connector, 1/4" MPT x 1/4" O.D. Compression	2	2	2	2	2	2	13229D **
330	Valve, 3-Way, Oil Filter	1	1	1	1	1	1	2030A
331	Bracket, Valve	1	1	1	1	1	1	35106A
332	Elbow, 1/4" 90° Male Compression	1	1	1	1	1	1	13375D
332A **	Control, Pressure Differential	1	1	1	1	1	1	1643V **
333	Gasket, Bearing Cover	1	1	1	1	1	1	31890A
334	Screw, 5/8" x 2" Hex Head Cap	10	10	10	10	10	10	13152E
335	Screw, 1/2" x 1 3/4" Hex Head Cap	8	8	8	8	8	8	2796EL

NOTES:

* Filter with bypass relief is standard beginning with S/N 45497 (oil unloaded) and 60080 (gas unloaded).

** Used when center tube (Spool Assembly, Item 311) without bypass relief is used.

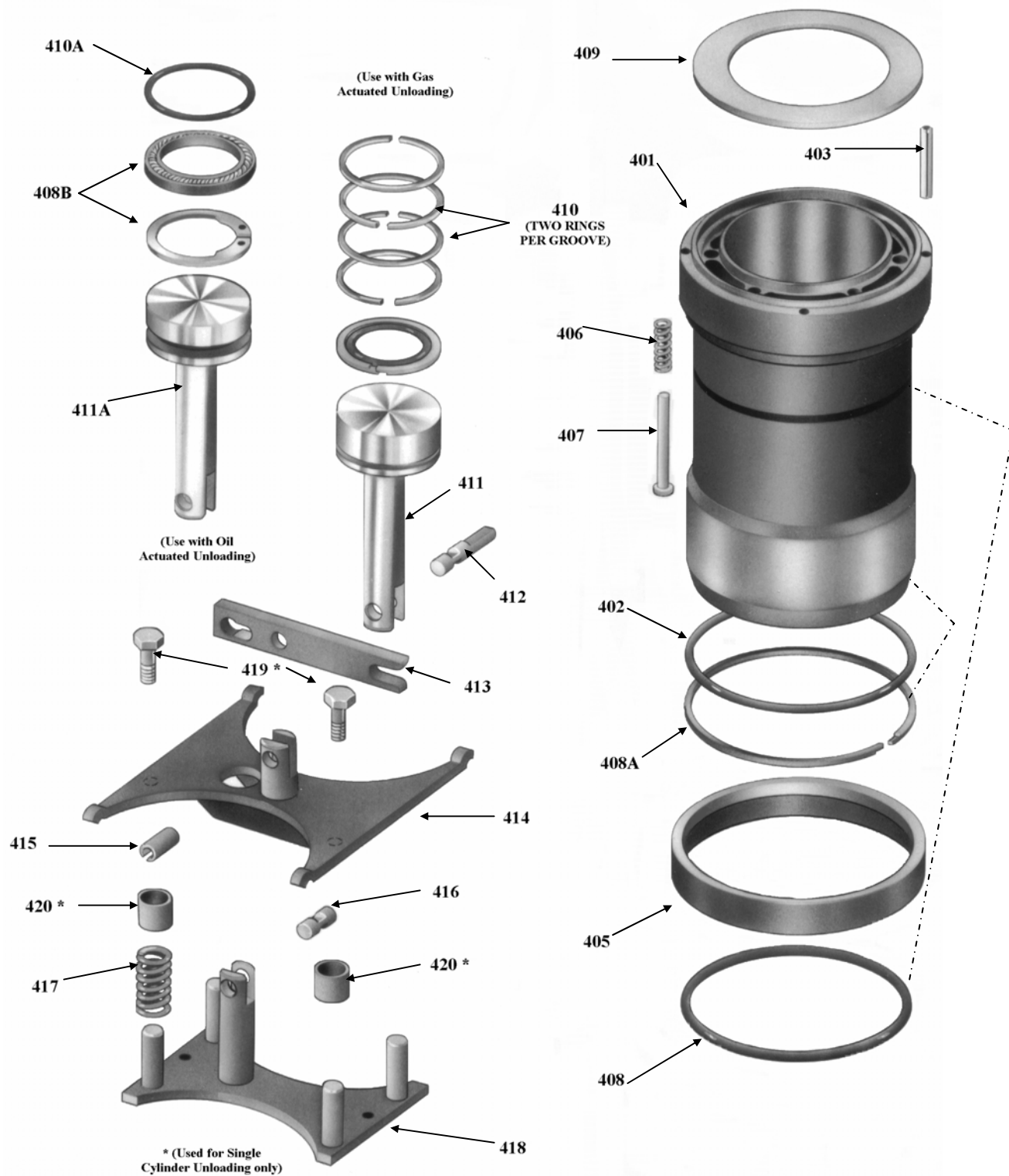
† Replacement recharge also includes gasket 1448B (Item 321).

VILTER MANUFACTURING CORPORATION

February 2001
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450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
FIGURE 7



February 2001
Replaces
March 1985

VILTER MANUFACTURING CORPORATION
450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

SECTION 102-R
PAGE 15

CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
(For All Serial Numbers Unless Otherwise Noted)

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
401, 402 & 403	Cylinder Liner Assembly (High-Stage) (for cylinder without unloading)	2(1*)	2	2	4	4	8	KT475
401, 402 Thru 408	Cylinder Liner Assembly (High-Stage) (for cylinder with unloading)	-(1*)	2	4	4	8	8	KT476
401A, 402, 403 & 408A	Cylinder Liner Assembly (Two-Stage) (for cylinder without unloading)	--	--	2(3*)	--	4(6*)	--	A35108D
401A, 402 Thru 408A	Cylinder Liner Assembly (Two-Stage) (for cylinder with unloading)	--	--	4(3*)	--	8(6*)	--	A35108C
401	Liner, Cylinder (High-Stage)	2	4	6	8	12	16	34510A
401A	Liner, Cylinder (Two-Stage)	--	--	6	--	12	--	34710A
402	Seal, 'O' Ring (upper High Stage & Two-Stage)	2	4	6	8	12	16	2176BH
403	Pin, Roll, 0.125" dia. X 1½" lg.	8	16	24	32	48	64	1193Q
405	Ring, Lift	-(1*)	2	4(3*)	4	8(6*)	8	35071A
406	Spring, Lift	-(8*)	16	32(24*)	32	64(48*)	64	35069A
407	Pin, Lift	-(8*)	16	32(24*)	32	64(48*)	64	35070A
408	Retainer, Lift Ring	-(1*)	2	4(3*)	4	8(6*)	8	1971A
408A +	Seal, 'O' Ring (lower – Two-Stage only)	--	--	6	--	12	--	2176BL
409	Plate, Suction Valve	2	4	6	8	12	16	31909A
410A	Piston Kit, Cap Red (Oil Actuated †)							
411A & 412	Serial Number 45,000 thru 45,999++	-(1*)	1	2(3*)	2	4(6*)	4	KT364
410	Piston Kit, Cap Red (Gas Actuated†)							
411 & 412	Serial Numbers 60,000 thru 61,199++	-(1*)	1	2(3*)	2	4(6*)	4	KT034
410	Piston Ring (Steel – For Gas Actuated)	-(4*)	4	8(12*)	8	16(24*)	16	31989L
410A	'O' Ring (Rubber – for 0.187" Groove)	-(1*)	1	2(3*)	2	4(6*)	4	2176AX
410B	Ring Set (PTFE – for 0.120" Groove)	-(1*)	1	2(3*)	2	4(6*)	4	2557A
411/411A	Piston, Unloader (Gas or Oil)	-(1*)	1	2(3*)	2	4(6*)	4	Order Kit
412	Pin, Long Pivot	-(1*)	1	2(3*)	2	4(6*)	4	33250C
413 Thru 420	Complete Capacity Control Mechanism Assembly Serial No. 45,000-45,999 & 60,000-61,199++ (2 Cylinder and Two-Stage) (High-Stage)	-(1*) --	-- 1	-(3*) 2	-- 2	-(6*) 4	-- 4	A33577A A33354A
413	Arm, Yoke Lifting	-(1*)	1	2(3*)	2	4(6*)	4	33338A
414	Yoke Assembly (2 Cylinder and Two-Stage)	-(1*)	--	-(3*)	--	-(6*)	--	A33575A
414	Yoke Assembly (High-Stage)	--	1	2	2	4	4	A33335A
415	Pin, 3/8" x 11/16" lg. Roll	-(1*)	1	2(3*)	2	4(6*)	4	1193X
416	Pin, Short Pivot	-(1*)	1	2(3*)	2	4(6*)	4	33250B
417	Spring, Unloader Yoke	-(4*)	4	8(12*)	8	16(24*)	16	33686A
418	Yoke Guide Assy (2 Cylinder and Two-Stage)	-(1*)	--	-(3*)	--	-(6*)	--	A33576A
418	Yoke Guide Assy (High-Stage)	--	1	2	2	4	4	A33347A
419	Screw, 3/8" x 1" Cap Lock	-(2*)	--	-(6*)	--	-(12*)	--	1352D
420	Spacer, Sleeve	-(2*)	--	-(6*)	--	-(12*)	--	33618A

NOTES:

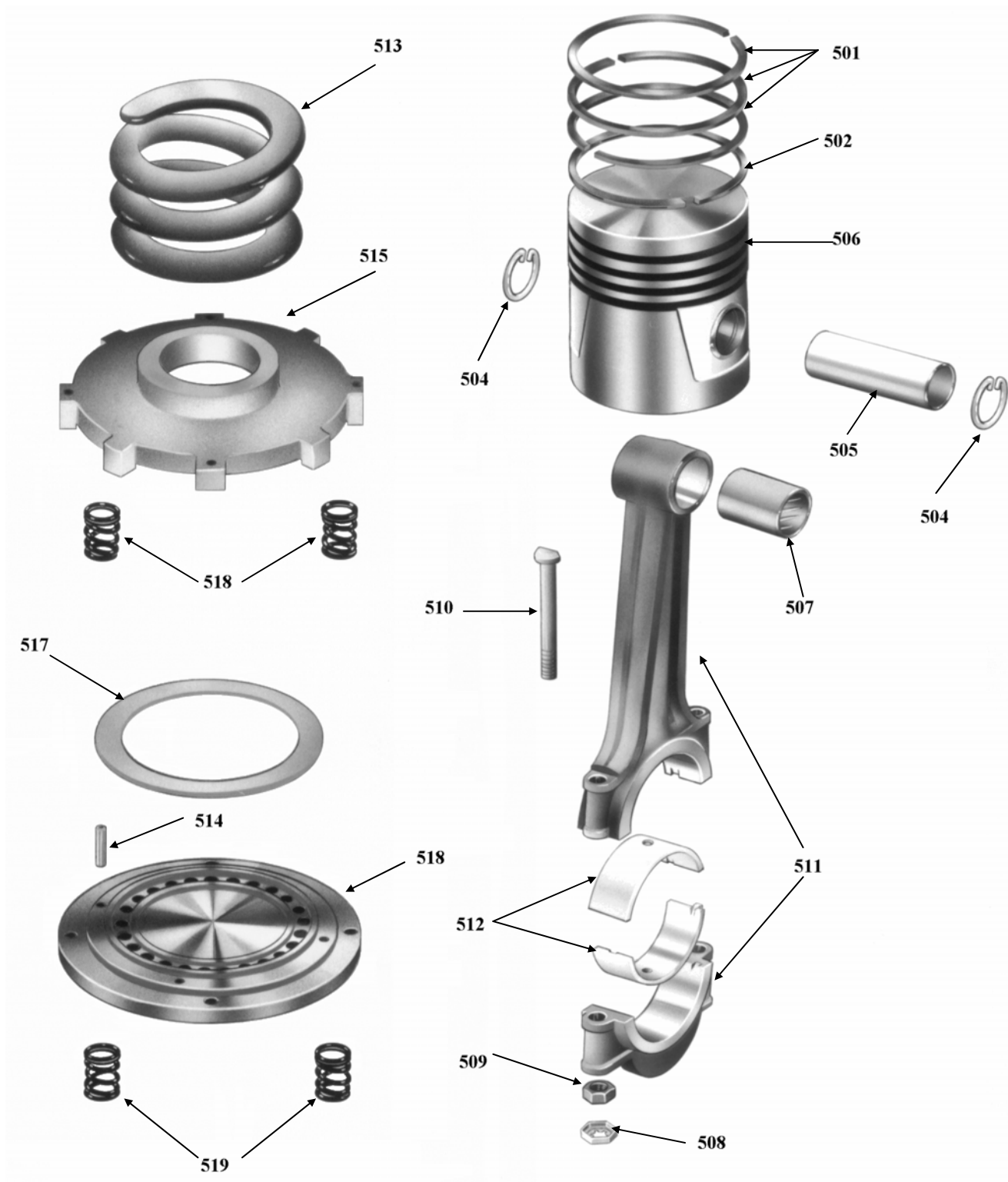
- * Except for 2 cylinder and Two-Stage machines, parts quantities are listed for standard unloading only. The 2 cylinder and Two-Stage quantities are listed in parentheses () for the 50% option. Standard unloading on compressors with 2 cylinders is none; 4 cylinders is 50%; 6 cylinders is 33 and 66%; 8 cylinders is 25 and 50%; 12 cylinders is 33 and 66%; 16 cylinders is 25 and 50%; and Two-Stage is none. See Operation Section for unloading options. Also, for single cylinder unloading, the yoke assembly (Item 414) and two pins on the yoke guide assembly (Item 418) have drilled and tapped holes to accommodate screws (Item 419) and spacers (Item 420).
- † Actuation type can be determined by checking the unloading solenoid valve – gas uses two-way valves, oil uses three-way valves. For oil unloaded compressors: In serial number range 45,000 thru 45,858, the design version of "unloader piston with one Rubber Ring in a 0.187 in. Groove" was used. In serial number range 45,859 thru 45,999, a "PTFE/Rubber Ring Set in a 0.120 in. Groove" was used. Pistons are interchangeable, but the rings are not.
- + This lower 'O' Ring Seal is for Two-Stage Compressors only. Some initial design High-Stage Compressors also had a similar seal. Its use on the High-Stage machine was discontinued because it is not really needed. It is no longer available. Do not order the Two-Stage Seal for use on these older High-Stage machines. It will not fit.
- ++ For serial numbers above these ranges, see Page 17.

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
March 1985

450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

**PISTON AND CONNECTING ROD ASSEMBLY
AND SAFETY HEAD REPLACEMENT PARTS
FIGURE 8**



February 2001
Replaces
March 1985

VILTER MANUFACTURING CORPORATION
450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

SECTION 102-R
PAGE 17

**PISTON AND CONNECTING ROD ASSEMBLY
AND SAFETY HEAD REPLACEMENT PARTS**

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
501 Thru 506	Piston, Rings and Pin Assembly Kit	2	4	6	8	12	16	KT213
501 Thru 512	Piston, Rings and Connecting Rod Assy Kit (All Compressors except 16 Cyl. High-Stage)	2	4	6	8	12	16	KT478
	Piston, Rings and Connecting Rod Assy Kit (Heavy Duty High-Stage #)	--	--	--	8	--	16	KT478A
501	Piston Ring, Compression	6	12	18	24	36	48	31989M
502	Piston Ring, Oil	2	4	6	8	12	16	31989N
504	Retaining Ring, Wrist Pin	4	8	12	16	24	32	33244A
505 and 506	Piston and Wrist Pin Assembly (matched)	2	4	6	8	12	16	***
507 Thru 512	Connecting Rod Assembly with Bearings Kit (All Compressors except 16 Cyl. High-Stage)	2	4	6	8	12	16	KT463
	Connecting Rod Assembly with Bearings Kit (Heavy Duty High-Stage #)	--	--	--	9	--	16	KT463A
507	Bushing, Wrist Pin	2	4	6	8	12	16	31896B *
508	Lock Nut, $\frac{3}{8}$ ", Connecting Rod	4	8	12	16	24	32	2028A
509	Nut, Plain Hex $\frac{3}{8}$ "-UNF	4	8	12	16	24	32	2027A
510	Bolt, Connecting Rod	4	8	12	16	24	32	31955A
511	Connecting Rod and Cap	2	4	6	8	12	16	**
+512	Bearing Half, Connecting Rod (All Compressors - Except 16 Cylinder High-Stage)							
	Standard Size	2	4	6	8	12	16	KT512
	0.015" Undersize	2	4	6	8	12	16	KT513A
	0.030" Undersize	2	4	6	8	12	16	KT513
512	Bearing Half, Connecting Rod (Heavy Duty High-Stage #)	--	--	--	8	--	32	35273ST
513	Spring, Safety Head	2	4	6	8	12	16	35252A
514	Safety Head and Pins Assembly (Standard Comp)	2	4	6	8	12	16	A35082A
and 518	Safety Head and Pins Assembly (Hi Suction Comp #)	2	4	6	8	12	16	A35272A
514	Pin, Roll, 0.187" dia. x $\frac{11}{16}$ " lg. †	8	16	24	32	48	64	1712F
515	Safety Head Yoke Kit (includes 4 of item 514)	2	4	6	8	12	16	KT543
516	Spring, Valve	16	32	48	64	96	128	33803A
517	Plate, Discharge Valve	2	4	6	8	12	16	35080SS
518	Safety Head	2	4	6	8	12	16	**
519	Spring, Valve	8	16	24	32	48	64	33803A

NOTES:

- A. Early 450 compressors were equipped with pistons having 2 compression rings and 2 oil control rings.
- * Replacement wrist pin bushing must be reamed after installation to properly accommodate wrist pin. See Service Instructions for additional details.
- ** Shown for disassembly purposes only. Order appropriate Kit or Assembly.
- *** Piston Assembly with three compression rings and one oil ring is standard beginning with serial number 45664 (oil unloading) and 60433 (gas unloading). It is a direct replacement for former piston assembly (two compression rings and two oil rings with expander). Piston ring part numbers are the same for either assembly. Current assembly is interchangeable with and can be mixed with former piston assemblies within a compressor. Do not use expanders in either assembly – they are no longer needed.
- † Install with pin's outside longitudinal seam facing outside diameter of safety head.
- # High Suction Pressure Compressors are identified by an 'X' in the serial number. Heavy Duty Compressors are identified by 'HD' in the serial number.
- + Do not use undersize bearing halves on 6, 8 and 12 Cylinder Belt Driven High-Stage compressors. Bearing half sets with quantities enough for one connecting rod are also available. For sets without Lock Nuts, order 35086ST, 41726ST, 35214ST or 35273ST. For sets with Lock Nuts, order KT512, KT513 or KT513A.

VILTER MANUFACTURING CORPORATION

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450 VMC COMPRESSORS

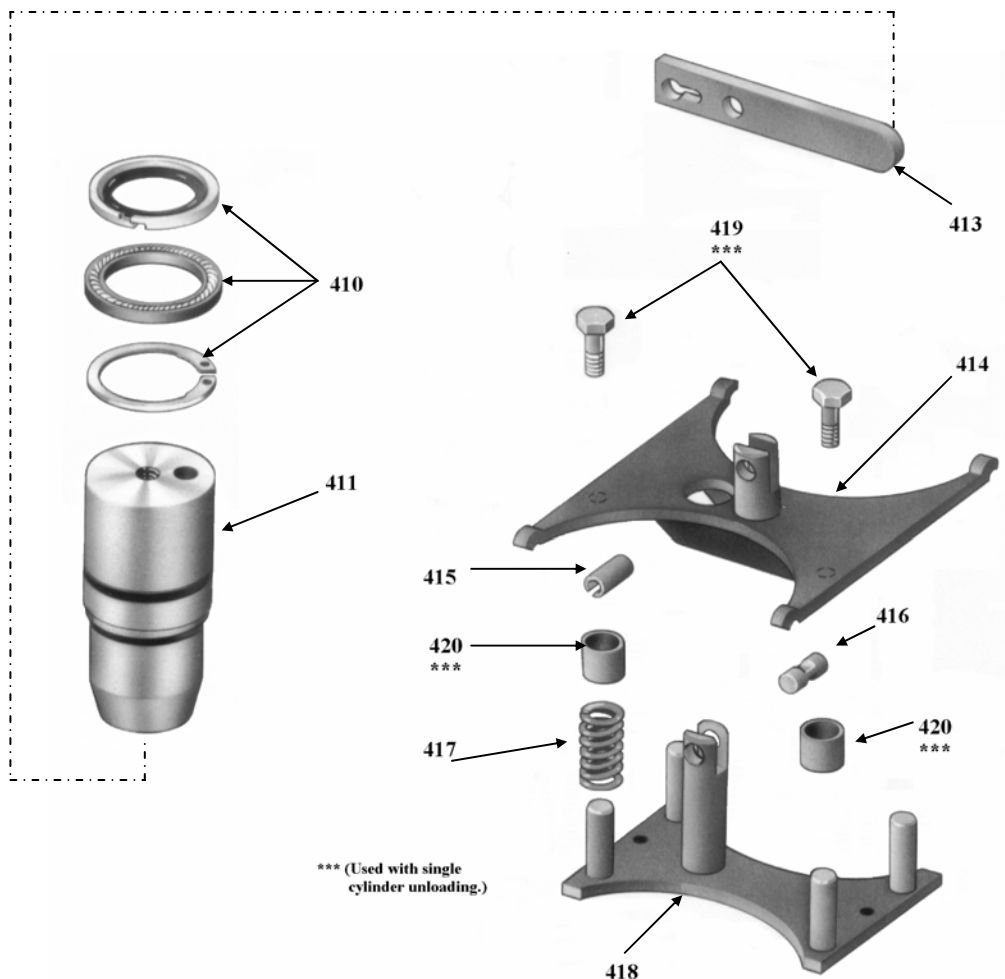
CAPACITY CONTROL MECHANISM (+) REPLACEMENT PARTS

Version used beginning with Serial Number:

61,200 for Gas Unloading.

46,000 for Oil Unloading (++)

FIGURE 9



ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR **						PART NUMBER
		NUMBER OF CYLINDERS						
		2	4	6	8	12	16	
410 & 411	Piston & Rings Assy, Cap Red (Gas or Oil†)	-(1*)	1	2(3*)	2	4(6*)	4	A35315CX
410	Ring Set (PTFE & rubber)	-(1*)	1	2(3*)	2	4(6*)	4	2557A
411	Piston, Unloader (Gas or Oil)	-(1*)	1	2(3*)	2	4(6*)	4	Order Assy
413	Complete Capacity Control Mechanism Assembly (2 Cylinder and Two-Stage only)	-(1*)	--	-(3*)	--	-(6*)	--	A41787AX
420	Complete Capacity Control Mechanism Assembly	--	1	2	2	4	4	A41788BX
413	Arm, Yoke Lifting	-(1*)	1	2(3*)	2	4(6*)	4	41725A
414	Yoke Assembly (2 Cylinder and Two-Stage only)	-(1*)	--	-(3*)	--	-(6*)	--	A33575A
414	Yoke Assembly	--	1	2	2	4	4	A33335A
415	Pin, 3⁄8" x 11⁄16" lg. Roll	-(1*)	1	2(3*)	2	4(6*)	4	1193X
416	Pin, Short Pivot	-(1*)	1	2(3*)	2	4(6*)	4	33250B
417	Spring, Unloader Yoke	-(4*)	4	8(12*)	8	16(24*)	16	33686A
418	Yoke Guide Assy (2 Cylinder and Two-Stage only)	-(1*)	--	-(3*)	--	-(6*)	--	A33576A
418	Yoke Guide Assembly	--	1	2	2	4	4	A33347A
419	Screw, 3⁄8" x 1" Cap Lock	-(2*)	--	-(6*)	--	-(12*)	--	1352D
420	Spacer, Sleeve	-(2*)	--	-(6*)	--	-(12*)	--	33618A

NOTES:

*, †, +, ++

See Pages 12 and 13 for notes and lower serial number applications.

February 2001
Replaces
March 1985

VILTER MANUFACTURING CORPORATION
450 VMC COMPRESSORS
(High-Stage, Two-Stage, Booster and Heavy Duty)

SECTION 102-R
PAGE 19

RECOMMENDED SPARE PARTS LIST

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
---	Gasket Kit, Complete	1	--	--	--	--	--	KT041
---	Gasket Kit, Complete	--	1	--	--	--	--	KT043
---	Gasket Kit, Complete	--	--	1	--	--	--	KT045
---	Gasket Kit, Complete	--	--	--	1	--	--	KT049
---	Gasket Kit, Complete	--	--	--	--	1	--	KT051
---	Gasket Kit, Complete	--	--	--	--	--	1	KT055
118	Safety Valve (Internal Relief)	1	1	1	1	1	1	1721B
217	Rotary Shaft Seal Assembly	1	1	--	--	--	--	A33483A
217	Rotary Shaft Seal Assembly	--	--	1	1	1	1	A33489A
306	Oil Pump Assembly	1	1	1	1	1	1	A33480A
315	Recharge, Oil Filter (Gasket 1448B included) (For use with 2046A and A35241A)	1	1	1	1	1	1	2115C
315	Recharge, Oil Filter (Gasket 14483 included) (For use with A35240A and 1448J)	1	1	1	1	1	1	1448C
401 Thru 404	Cylinder Liner Assembly Kit (for cylinder without unloading, High-Stage) (for cylinder without unloading, Two-Stage)	1 --	1 --	2 1	2 --	2 1	2 --	KT475 A35108D
401 Thru 408	Cylinder Liner Assembly Kit (for cylinder with unloading, High-Stage) (for cylinder with unloading, Two-Stage) *	1 --	1 --	2 1	2 --	2 1	2 --	KT476 A35108C
409	Plate, Suction Valve	2	4	6	8	12	16	31909A
413 Thru 420	Capacity Control Assembly Two Cylinder and Two-Stage Compressor * 4 thru 16 Cylinder Compressors	1 --	-- 1	1 1	-- 1	1 1	-- 1	A33577A A33354A
501 Thru 512	Piston, Rings and Connecting Rod Assembly Kit (All Compressors except 16 Cyl. High-Stage) Piston, Rings and Connecting Rod Assembly Kit (Heavy Duty High-Stage #)	1 --	1 --	2 --	2 2	2 --	2 2	KT478 KT478A
501	Piston Ring, Compression	6	12	18	24	36	48	31989M
502	Piston Ring, Oil	2	4	6	8	12	16	31989N
508	Lock Nut, $\frac{3}{8}$ ", Connecting Rod	8	16	24	32	48	64	2028A
512	Bearing Half, Connecting Rod (All Compressors except 16 Cyl. High-Stage)	2	4	6	8	12	16	35086ST or KT512
512	Bearing Half, Conn. Rod (Heavy Duty High-Stage #)	--	--	--	8	--	16	35273ST
516 & 519	Spring, Valve	24	48	72	96	144	192	33803A
517	Plate, Discharge Valve	2	4	6	8	12	16	35080SS
514 & 518	Safety Head and Pins Assembly (Standard Comp) Safety Head and Pins Assembly (Hi-Suct Comp #)	1 1	2 2	2 2	2 2	2 2	2 2	A35082A A35272A

NOTES:

A. The above listing includes the minimum selection and quantity of recommended spare parts. All items listed do not necessary apply to every compressor, because of type, size or optional features. Items should be selected for each individual compressor as they apply.

* When supplied, capacity reduction is optional,

High Suction Pressure Compressors are identified by an 'X' in the serial number. Heavy Duty Compressors are identified by 'HD' in the serial number.

**440 VMC COMPRESSORS
REPLACEMENT PARTS LIST**

TABLE OF CONTENTS

<u>PAGE</u>	
1A	REPLACEMENT PARTS ORDERING INSTRUCTIONS
	BASIC FRAME REPLACEMENT PARTS
2	Illustration, 2 Cylinder (Figure 1)
3	Illustration, 4, 6 & 8 Cylinder (Figure 2)
4	Illustration, 12 & 16 Cylinder (Figure 3)
5	Parts List
	CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
7	Illustration, 2 thru 8 Cylinder (Figure 4)
8	Illustration, 12 and 16 Cylinder (Figure 5)
9	Parts List
	REAR BEARING COVER REPLACEMENT PARTS
12	Illustration, with Standard Tri-Micro [®] Filter Option (Figure 6)
13	Parts List
14	Illustration, with Tri-Micro [®] Filter Option (Figure 7)
15	Parts List
	CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
16	Illustration (Figure 8)
17	Parts List
	CAPACITY CONTROL MECHANISM ASSEMBLY REPLACEMENT PARTS
19	Illustration (Figure 9)
19	Parts List
	PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS
20	Illustration (Figure 10)
21	Parts List
24	MODERNIZING 1200 RPM COMPRESSORS
	CYLINDER LINER & CAPACITY CONTROL REPLACEMENT PARTS (SERIAL NUMBERS BELOW 3638)
25	Illustration (Figure 11)
26	Parts List
	PISTON AND CONNECTING ROD REPLACEMENT PARTS (SERIAL NUMBERS BELOW 3638)
28	Illustration (Figure 12)
29	Parts List
	CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS (SERIAL NUMBERS BELOW 9999)
31	Parts List
32	HEAVY DUTY V-BELT DRIVEN REPLACEMENT PARTS
32	Parts List
33	RECOMMENDED SPARE PARTS LIST

REPLACEMENT PARTS ORDERING INSTRUCTIONS

1. Give the size and speed of the compressor, as well as serial number and refrigerant used. When recording serial number, be certain to include letters (i.e. A, AH, R22S, R12H, etc.) which precedes the actual serial number. This will establish whether the compressor is built for 1000 RPM or 1200 RPM.

The serial number is stamped on the nameplate and the compressor frame. On 2 cylinder compressors, the frame serial number location is directly below the cylinder cover on the crankcase handhole side. On 4 thru 16 cylinder compressors, the frame serial number location is directly above the suction flange or directly above the rear bearing cover. The rear bearing is located on the oil pump/filter end of the compressor.

2. Always give the name of the part as well as the corresponding part number and/or item number. Also include the number of parts required.
3. Should there be a doubt regarding the part number or name, send a sketch of the part required, or return the old part as a sample, transportation charges prepaid. Orders on which part numbers and description do not agree will be filled according to our best interpretation.
4. If parts that appear on the parts list do not appear on the price list, it is because they are sold only as an assembly. All prices shown on the list are F.O.B. factory. Minimum domestic parts order is \$75.00 net price. Prices are for a single item unless otherwise specified in the price list.
5. Please indicate on the order the preferred method of shipment. We will follow your instructions unless it is to your best interest to change routing.
6. If you purchased the compressor from a party other than Vilter Manufacturing Corporation, please state when you purchased the compressor and from whom.

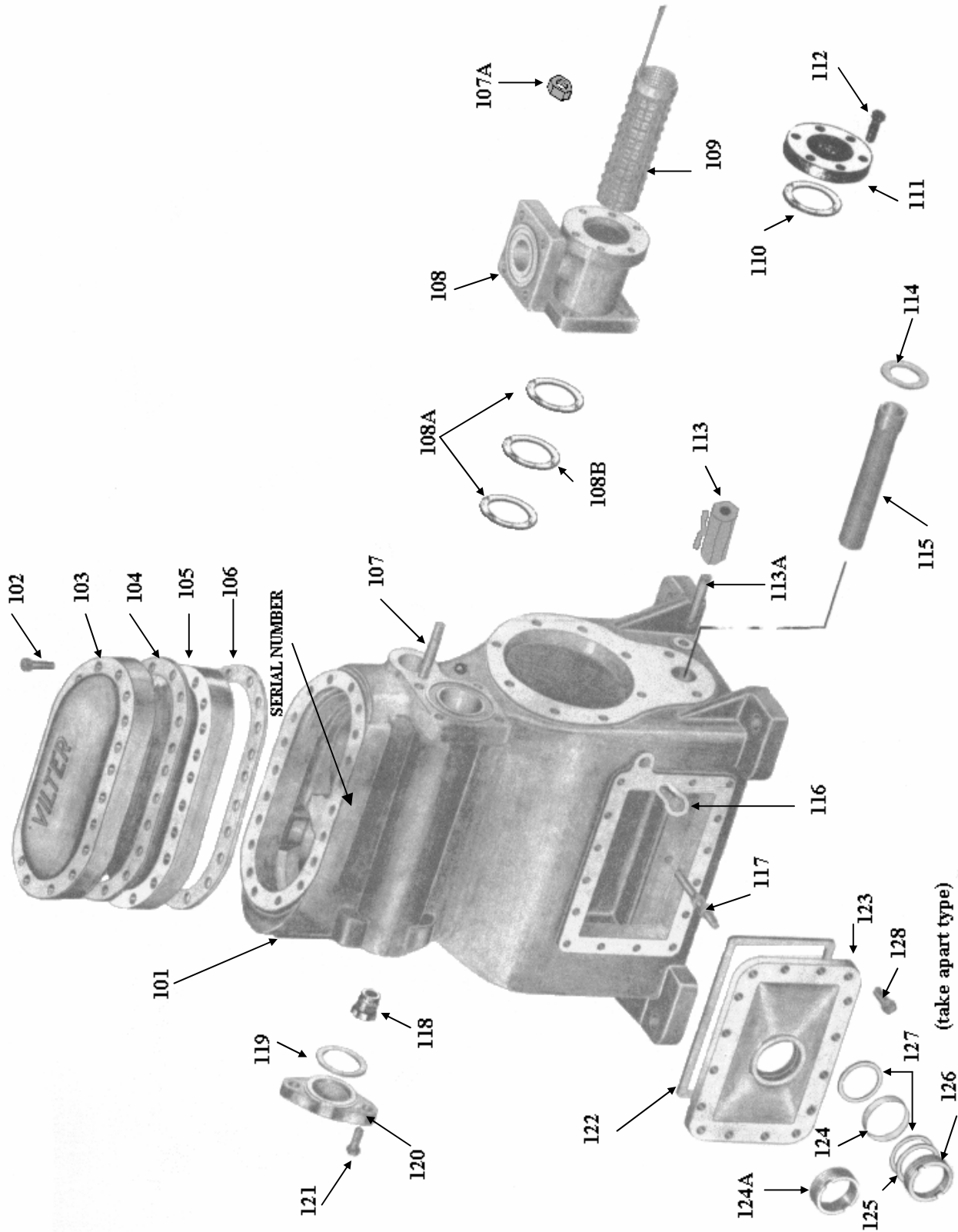
FEBRUARY 2001
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VILTER MANUFACTURING CORPORATION

SECTION 105-R
PAGE 2

440 VMC COMPRESSORS

BASIC FRAME REPLACEMENT PARTS
FOR 2 CYLINDER VMC COMPRESSORS
FIGURE 1

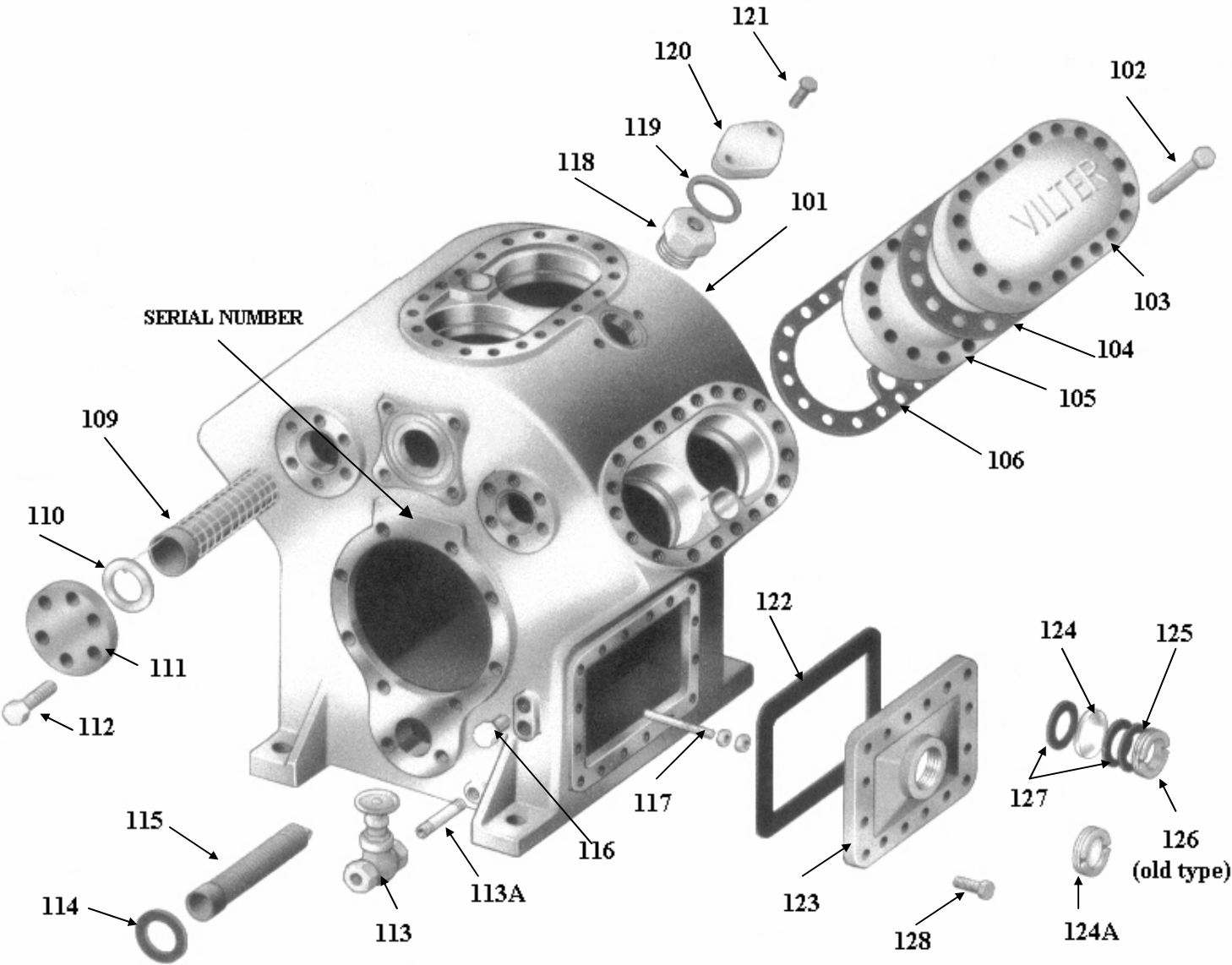


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February 2001
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March 1969

440 VMC COMPRESSORS

BASIC FRAME REPLACEMENT PARTS FOR
4, 6 & 8 CYLINDER VMC COMPRESSORS
FIGURE 2



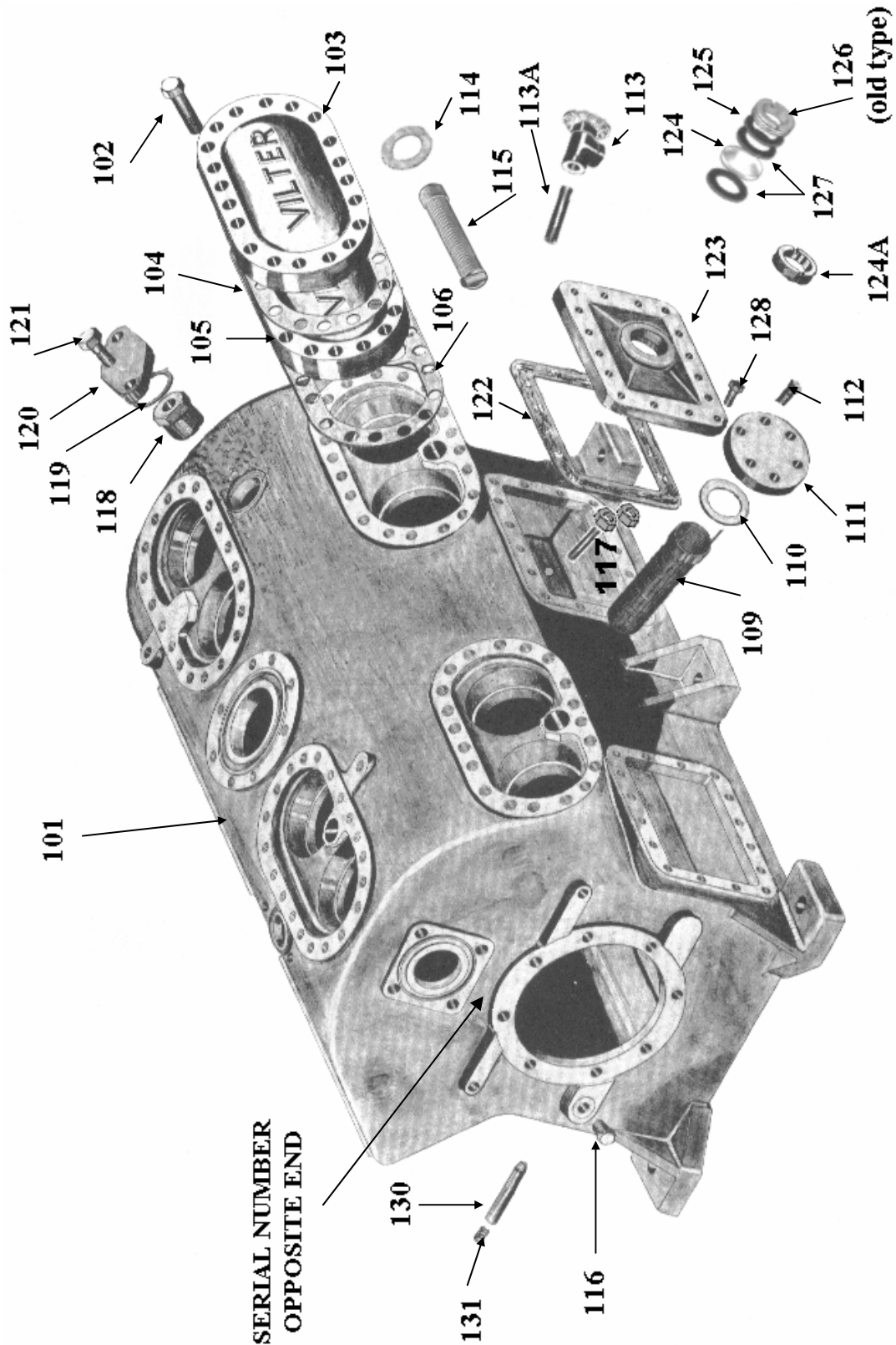
February 2001
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March 1969

VILTER MANUFACTURING CORPORATION

SECTION 105-R
PAGE 4

440 VMC COMPRESSORS

BASIC FRAME REPLACEMENT PARTS FOR
12 & 16 CYLINDER VMC COMPRESSORS
FIGURE 3



VILTER MANUFACTURING CORPORATION

November 2001
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February 2001

440 VMC COMPRESSORS

BASIC FRAME REPLACEMENT PARTS FOR ALL VMC COMPRESSORS

ITEM	DESCRIPTION NO. OF CYL.	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO-STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
101	Frame	1	1	1	1	1	1	1	1	---	---	*
102	Screw, 5/8" x 3½" Hex Head Cap (Used with Water Jacket)	20	40	60	80	120	160	20	40	0	Present	13152L
102	Screw, 5/8" x 2½" Hex Head Cap (Used without Water Jacket)	20	40	60	80	120	160	40	80	0	Present	13152G
103	Cover, Water Jacket (Amm & R22)	1	2	3	4	6	8	1	2	0	Present	30299A
104	Gasket, Water Jacket (Amm & R22)	1	2	3	4	6	8	1	2	0	Present	33329A
105	Cover, Cylinder **											
	Without Capacity Reduction	--	1	--	2	--	4	--	--	0	Present	A30332A
	With Capacity Reduction, Oil Type	-	1†	--	2†	--	4†	--	--	0	Present	30332B
	With Capacity Reduction, Gas Type	--	1	--	2	--	4	--	--	0	Present	30332G
	Without Capacity Reduction	1	--	1	--	2	--	3	6	0	Present	A30364A
	With Capacity Reduction, Oil Type	1†	--	2†	--	4†	--	2†	6†	0	Present	30364B
	With Capacity Reduction, Gas Type	1†	--	2	--	4	--	--	--	0	Present	30364G
	With Capacity Reduction, Two-Stage	--	--	--	--	--	--	1†	--	0	Present	30364F
106	Gasket, Cylinder Cover	1	2	3	4	6	8	3	6	0	Present	33330A
107	Stud, 5/8" x 3" (shown only on 2 cyl.)	8	4	4	4	8	8	4	8	0	Present	13156D
107	Stud, ¾" x 3¼" (not shown)	--	4	4	4	--	--	4	--	0	Present	13157D
108	Tee, Suction											
	2½" x 2½" (all)	1	--	--	--	--	--	--	--	0	Present	30319A
	3½" x 2½" (Ammonia)	--	1	--	--	--	--	--	--	0	Present	32417C
	3½" x 3" (Halocarbon)	--	1	--	--	--	--	--	--	0	Present	32417B
	3" x 4" (Amm & Boosters)	--	--	1	--	--	--	1	--	***	***	36254A
	4" x 4" (Halocarbon)	--	--	1	--	--	--	--	--	***	***	36254B
	4" x 4" (Amm & Boosters)	--	--	--	1	--	--	--	--	***	***	36254B
	5" x 4" (Halocarbon)	--	--	--	1	--	--	--	--	***	***	36254C
	Elbow, Suction											
	4" x 3" (Amm & Boosters)	--	--	1	--	--	--	1	--	0	***	32418A
	4" x 4" (Halocarbon)	--	--	1	--	--	--	--	--	0	***	12273C
109	Screen, Suction (Right & Left Side)	1	--	2	2	--	--	2	--	0	***	A32428D
	Screen, Suction	--	1	--	--	--	--	--	--	0	Present	A32428A
	Screen, Suction (Center)	--	--	--	1	--	--	--	--	0	***	A32428C
	Screen, Suction	--	--	--	--	2	2	--	1	0	Present	A32565A
	Screen, Suction (R.H. Side, 8 cyl., 75% Cap. Red.)	1	--	2	3	--	--	2	--	0	***	A32428D
	Screen, Suction	--	--	1	1	--	--	1	--	***	***	A35215A
109-A	Bag, Suction Screen (not shown)	--	1	--	--	--	--	--	--	0	Present	A33474A
	Bag, Suction Screen (not shown)	1	--	2	3	--	--	2	--	0	***	A33474B
	Bag, Suction Screen (not shown)	--	--	--	--	2	2	--	1	0	Present	A33474G
	Bag, Suction Screen (not shown)	--	--	1	1	--	--	1	--	***	***	A35234A
110	Gasket, Suction Screen Cover	1	--	2	2	--	--	2	--	0	***	31892A
	Gasket, Suction Screen Cover	--	--	--	--	2	2	--	1	0	Present	33493A
	Gasket, Suction Tee Cover	--	1	--	1	--	--	1	--	0	***	11323J
	Gasket, Suction Tee Cover	--	--	1	1	--	--	1	--	***	***	35217A
111	Cover, Suction Screen	1	--	2	2	--	--	2	--	0	Present	31893A
	Cover, Suction Screen	--	--	--	--	2	2	--	1	0	Present	33492A
	Cover, Suction Tee (for VPN 32010)	--	1	--	1	--	--	--	--	0	***	13706A
	Cover, Suction Tee (for VPN 36254)	--	--	1	1	--	--	1	--	***	***	35216A

NOTES:

- * Part Number on application.
- ** Quantities shown are for compressors with standard capacity reduction, and will vary if compressor is equipped with additional steps of capacity reduction.
- † Items shown are for compressors with optional oil unloading or optional single cylinder unloading.
- *** 6 cylinder compressors with serial numbers below 21937 (oil unloading) and 30039 (gas unloading) are equipped with a suction elbow and two suction screens (VPN A32428D) located behind the suction screen covers on the frame. 6 cylinder compressors with serial numbers 21937 (oil unloading), and 30039 (gas unloading) and above are equipped with a suction tee (VPN 36254 series) and a single suction screen (VPN 35215A) located in the suction tee. 8 cylinder compressors with serial numbers below 21937 (oil unloading) and 30039 (gas unloading) are equipped with a suction tee (VPN 32010) and three suction screens, one in the tee and two behind the suction screen covers on the frame. 8 cylinder compressors with serial numbers 21937 (oil unloading), and 30039 (gas unloading) and above, are equipped with suction tee (VPN 36254 series) and a single suction screen (VPN A35215A) located in the suction tee.

February 2001

Replaces

February 1985

VILTER MANUFACTURING CORPORATION

SECTION 105-R

PAGE 6

440 VMC COMPRESSORS**BASIC FRAME REPLACEMENT PARTS FOR ALL VMC COMPRESSORS**

ITEM	DESCRIPTION	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO-STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
	NO. OF CYL.											
112	Screw, 5/8" x 1 1/2" Hex. Head Cap	--	5	--	5	--	--	--	--	0	*	13152C
112	Screw, 5/8" x 1 3/4" Hex. Head Cap *	--	--	6	6	--	--	6	--	*	*	13152D
112	Screw, 1/2" x 1 1/2" Hex. Head Cap	6	--	12	12	--	--	12	--	0	Present	2796E
112	Screw, 1/2" x 1 1/4" Hex. Head Cap	--	--	--	--	16	16	--	16	0	Present	2796EJ
113	Valve, 1/2" Oil Charge & Drain (Ammonia)	1	1	1	1	1	1	1	1	0	Present	A15375A
113	Valve, 1/2" Oil Charge & Drain (Halo.)	1	1	1	1	1	1	1	1	0	Present	1956A
114	Gasket, Crankcase Oil Screen	1	1	1	1	1	1	1	1	0	Present	31889A
115	Crankcase Oil Screen Assembly	1	1	1	1	1	1	1	1	0	Present	A31886A
116	Plug, 3/4" Hex. Head Pipe (not shown on 12 & 16)	1	1	1	1	1	1	1	1	0	Present	13264E
116	Plug, 1/2" Hex. Head Pipe (not shown on 2 thru 8)	1	1	1	1	1	1	1	1	0	Present	13264D
117	Pin Retaining Assy, Crankcase Oil Screen	1	1	1	1	1	1	1	1	0	Present	A31936A
118	Safety Valve (Internal Relief)	1	1	1	1	2	2	--	--	0	Present	1721B
118A	Valve, Crankcase Check (not shown)	--	--	--	--	--	--	2	2	---	---	A33568A **
119	Gasket, 2" Flange	1	1	1	1	2	2	--	--	0	Present	11323G
120	Cover, Safety Valve	1	1	1	1	2	2	--	--	0	Present	31954A
121	Screw, 5/8" x 2" Hex. Head Cap	2	2	2	2	4	4	--	--	0	Present	13152E
122	Gasket, Handhole Cover	1	1	1	1	2	2	1	2	0	Present	31894A
123 & 124A	Handhole Cover and 2" Sight Glass Assy With openings for:											
	560W NEMA 1&7 Htr, F.V. & Therm	1	1	1	1	1	1	1	1	0	Present	A33034G
	300W NEMA 1&7 Htr, F.V. & Therm	1	1	1	1	1	1	1	1	0	Present	A33034GA
	560W NEMA 1&7 Heater & Therm	1	1	1	1	1	1	1	1	0	Present	A33034L
	300W NEMA 1&7 Heater & therm	1	1	1	1	1	1	1	1	0	Present	A33034LA
	560W NEMA 1&7 Heater & Float Valve	1	1	1	1	1	1	1	1	0	Present	A33034G
	560W NEMA 1&7 Heater	1	1	1	1	1	1	1	1	0	Present	A33034L
123	Cover, Handhole (with openings)	1	1	1	1	1	1	1	1	0	Present	Order Assy
123A	Cover, Handhole (without openings)	--	--	--	--	1	1	--	1	0	Present	33034B
124A	Glass, Oil Sight – 2"	1	1	1	1	1	1	1	1	13050	Present	1484A
124 +	Glass, Oil Sight – 3"	1	1	1	1	1	1	1	1	0	13049	31212A
125 +	Washer, Oil Sight Glass – 3"	1	1	1	1	1	1	1	1	0	13049	31636A
126 +	Lock, Oil Sight Glass – 3"	1	1	1	1	1	1	1	1	0	13049	31211A
127 +	Gasket, Oil Sight Glass – 3"	2	2	2	2	2	2	2	2	0	13049	31226A
128	Screw, 1/2" x 1 1/2" Hex. Head Cap	16	16	16	16	32	32	16	32	0	Present	2796E
130	Tube, Oil Feed Connector	--	--	--	--	1	1	--	1	0	Present	33494A
131	Spring	--	--	--	--	1	1	--	1	0	Present	31789A

NOTES:

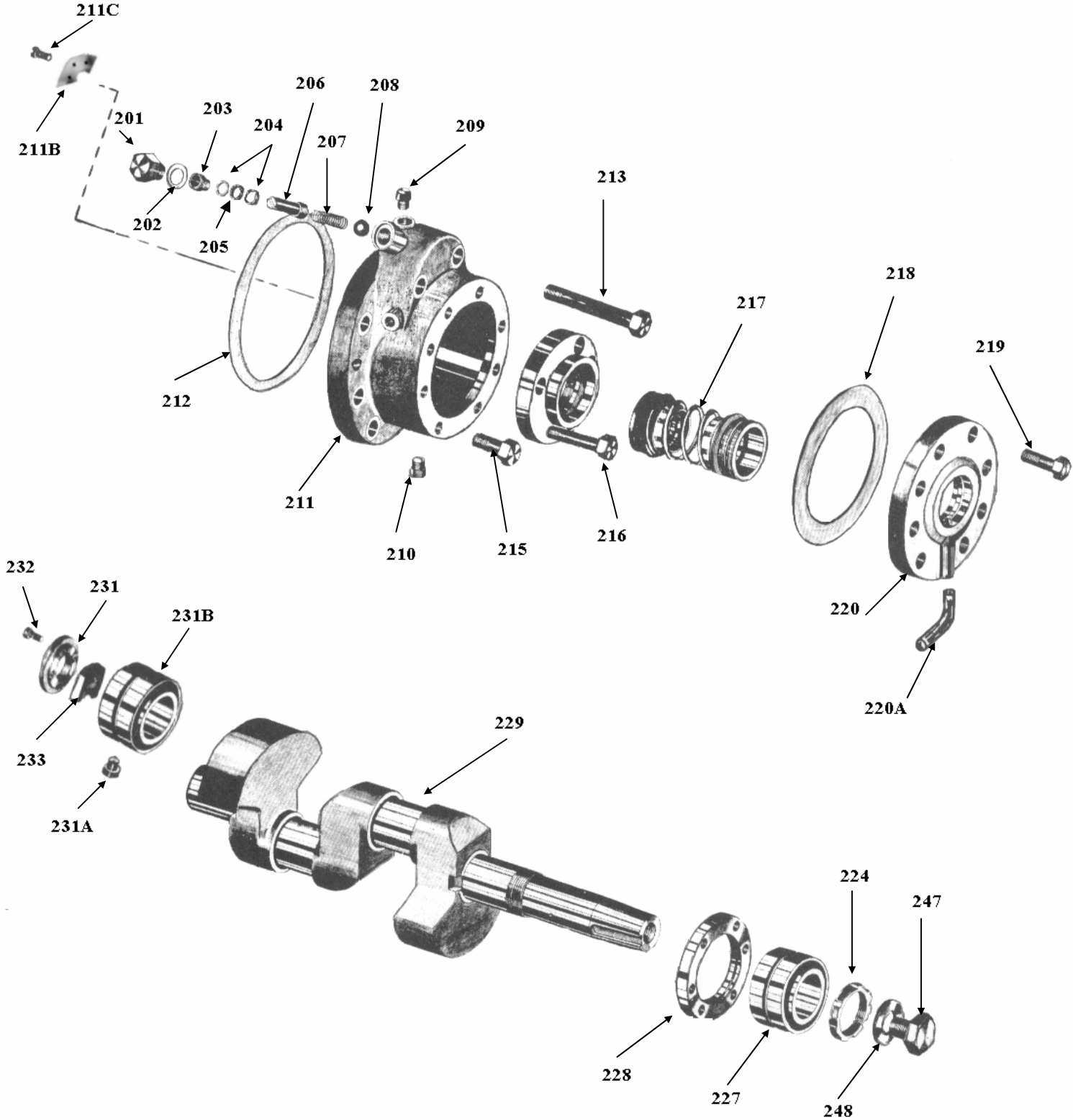
* See Note ***, Page 5.

** For use on compressors without external oil drain arrangement.

+ The crankcase cover for the 3" sight glass is not available, but these sight glass parts can still be supplied.

440 VMC COMPRESSORS

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
2 THRU 8 CYLINDER COMPRESSORS
FIGURE 4



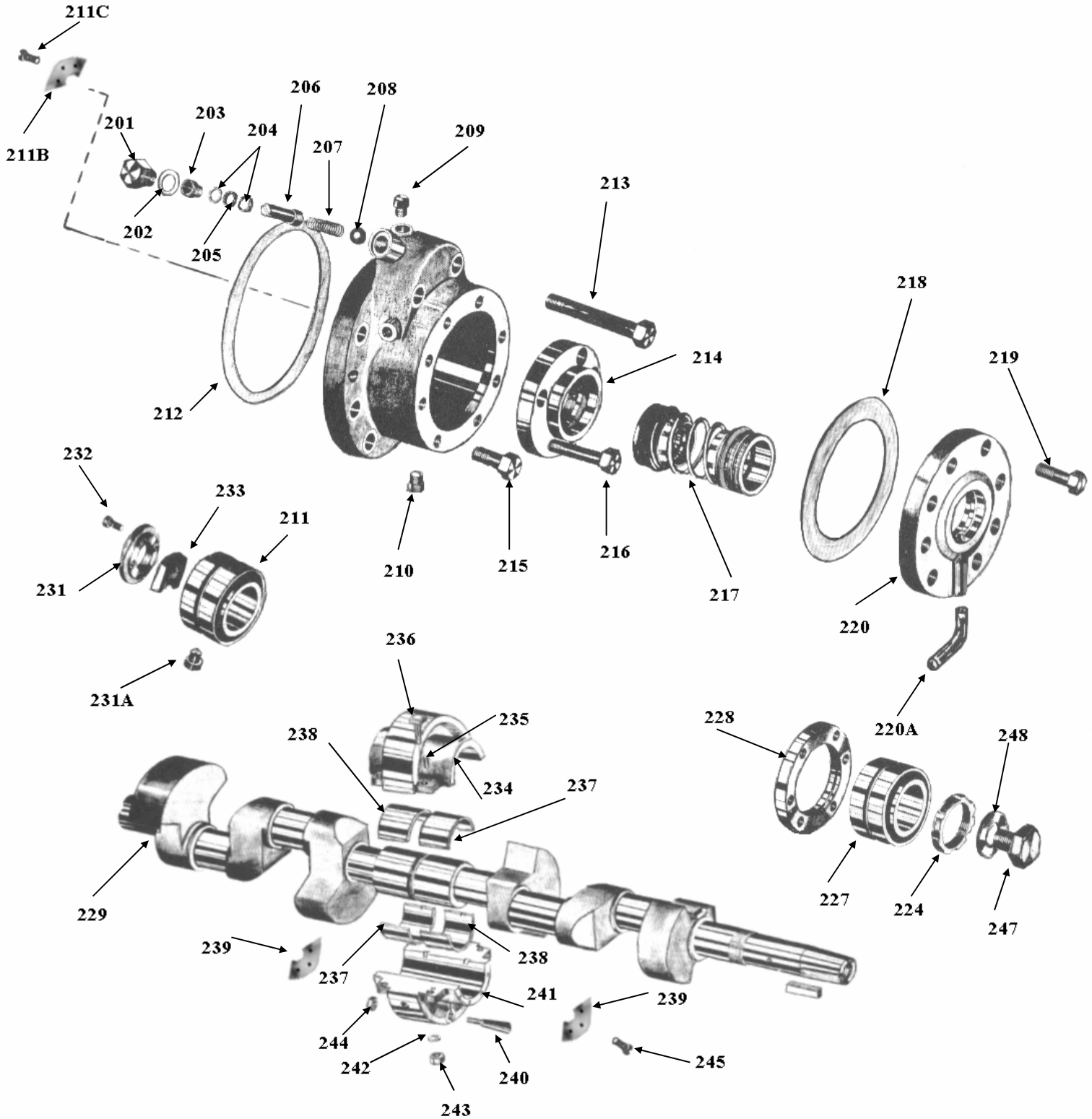
February 2001
Replaces
April 1984

VILTER MANUFACTURING CORPORATION

SECTION 105-R
PAGE 8

440 VMC COMPRESSORS

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS 12 AND 16 CYLINDER COMPRESSORS FIGURE 5



VILTER MANUFACTURING CORPORATION

February 2001
Replaces
April 1984

440 VMC COMPRESSORS

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS

ITEM	DESCRIPTION	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO-STAGE		FROM	THRU	
		NO. OF CYL.										
		2	4	6	8	12	16	6	12			
The following complete crankshaft sub-assemblies are available for all 440 VMC Compressors with aluminum pistons for 1000 RPM compressors from serial number 3068 thru present and for 1200 RPM compressors from serial number 1660 thru present. ***												
201 Thru 233	Complete Crankshaft Sub-Assembly Kit Complete Crankshaft Sub-Assembly Kit Complete Crankshaft Sub-Assembly Kit Complete Crankshaft Sub-Assembly Kit	1 -- -- --	-- 1 -- --	-- -- 1 --	-- -- -- 1	-- -- -- --	-- -- -- --	-- -- 1 --	-- -- 1 --	See Note Above		KT077 KT078 KT079 KT080
201 Thru 245	Complete Crankshaft Sub-Assembly Kit Complete Crankshaft Sub-Assembly Kit	-- --	-- --	-- --	-- --	1 --	-- 1	-- --	1 --			See Note Above
201 Thru 211A	Front Brg. Cover & Relief Valve Assy. Front Brg. Cover & Relief Valve Assy.	1 --	1 --	1 --	1 --	-- 1	-- 1	1 --	-- 1	0 0	Present Present	
201 202 203 204 205 206 207 208	Cap, Valve Gasket Nut, Packing Washers Packing, 7/8" O.D. x 39/64" I.D. x 3/8" Stem, Valve Spring Ball, 5/8" Dia. Steel	1 1 1 2 1 1 1 1	1 1 1 2 1 1 1 1	1 1 1 2 1 1 1 1	1 1 1 2 1 1 1 1	1 1 1 2 1 1 1 1	1 1 1 2 1 1 1 1	1 1 1 2 1 1 1 1	1 1 1 2 1 1 1 1	0 0 0 0 0 0 0 0	Present Present Present Present Present Present Present Present	17355A 30651C 31048A 31048D 31048B 31048C 31048F 13155K
209 Thru 211A	Front Bearing Cover Assembly ††† Front Bearing Cover Assembly †††	1 --	1 --	1 --	1 --	-- 1	-- 1	1 --	-- 1	See note††† See note†††	Present Present	A36240A A36241A
209 210 211 211 211A 211B 211C 212 213	Plug, 1/4" Hex. Head Pipe Plug, 3/8" Hex (not used after 12/81) Cover, Front Bearing Cover, Front Bearing Orifice, Oil Metering Shield, Splash (Oil Relief Outlet Hole) Screw, Rd Hd No. 10-32 x 3/8" Lg. Gasket, Bearing Cover Screw, 5/8" x 4" Hex, Socket Head Cap	1 1 1 -- 1 1 3 1 2	1 1 1 -- 1 1 3 1 2	1 1 1 -- 1 1 3 1 2	1 1 1 -- 1 1 3 1 2	1 1 -- 1 1 1 1 1 2	1 1 -- 1 1 1 1 1 2	1 1 1 -- 1 1 1 1 2	1 1 -- 1 1 1 1 2			0 0 0 0 0 0 0 0 0
214 214	Retainer, Front Bearing (w/oil hole)††† Retainer, Front Bearing (w/oil hole)†††	1 --	1 --	1 --	1 --	-- 1	-- 1	1 --	-- 1	See note††† See note†††	Present Present	31885A 33500A
215 216 217 217 218 218 219 220 220 220A	Screw, 5/8" x 2" Hex Head Cap Screw, 1/2" x 4" Hex Head Cap Seal, Rotary Shaft Assembly Seal, Rotary Shaft Assembly Gasket, Shaft Seal Cover Gasket, Shaft Seal Cover Screw, 1/2" x 1 3/4" Hex Head Cap Cover, Shaft Seal Cover, Shaft Seal Tube, Oil Drain	6 3 1 -- 1 -- 8 1 -- 1	6 3 1 -- 1 -- 8 1 -- 1	6 3 1 -- 1 -- 8 1 -- 1	6 3 1 -- 1 -- 8 1 -- 1	6 3 -- 1 -- 1 -- 8 -- 1 1	6 3 -- 1 -- 1 -- 8 -- 1 1	6 3 1 -- 1 -- 8 1 -- 1	6 3 -- 1 -- 1 -- 8 1 -- 1			0 0 0 0 0 0 0 0 0 0
224 Thru 233	Complete Crankshaft Assy (1200 RPM) For Aluminum Pistons * For Aluminum Pistons * For Aluminum Pistons * For Aluminum Pistons *	1 -- -- --	-- 1 -- --	-- -- 1 --	-- -- -- 1	-- -- -- --	-- -- -- --	-- -- 1 --	-- -- 1 --	1660 1660 1660 1660	Present Present Present Present	A32574A A32574B A32574C A32574D

NOTE:

* See page 31 for serial numbers below 1660.

** Sold only in Front Bearing Cover Assembly.

*** Crankshafts for Cast Iron Piston for these machines are no longer available. Use current crankshaft and convert the compressor to aluminum pistons.

††† See note with same symbol on Page 11.

February 2001

Replaces

April 1984

VILTER MANUFACTURING CORPORATION

SECTION 105-R

PAGE 10

440 VMC COMPRESSORS**CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS**

ITEM	DESCRIPTION NO. OF CYL.	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO- STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
224 Thru 233	Complete Crankshaft Assy (1000 RPM) For Aluminum Pistons For Aluminum Pistons For Aluminum Pistons For Aluminum Pistons	1 -- -- --	-- 1 -- --	-- -- 1 --	-- -- -- 1	-- -- -- --	-- -- -- --	-- -- 1 --	-- -- -- --	3068 3068 3068 3068	Present Present Present Present	A32574A A32574B A32574C A32574D
224 Thru 245 (less items 225, 226, 230, 234, 235 & 241)	Complete Crankshaft Assembly Kit 1000 or 1200 RPM, for Aluminum Pistons 1000 or 1200 RPM for Aluminum Pistons	-- --	-- --	-- --	-- --	1 --	-- 1	-- --	1 --	0 0	Present Present	KT068 KT069
224††	Locknut and Retaining Compound Kit	1	1	1	1	--	--	1	--	0	Present	KT366 ++
224††	Locknut and Retaining Compound Kit	--	--	--	--	1	1	--	1	0	Present	KT367 ++
227 *	Front Bearing and Retaining Compound Kit	1	1	1	1	--	--	1	--	0	Present	KT368
227	Front Bearing and Retaining Compound Kit	--	--	--	--	1	1	--	1	0	Present	KT369
228	Ring, Front Bearing Retainer	1	1	1	1	--	--	1	--	0	Present	33144A
228	Ring, Front Bearing Retainer	--	--	--	--	1	1	--	1	0	Present	33145A
229†	Crankshaft (1200RPM) (with oilway plugs)											
	For Aluminum Pistons (††)	1	--	--	--	--	--	--	--	1660 +	Present	KT370
	For Aluminum Pistons (††)	--	1	--	--	--	--	--	--	1660 +	Present	KT371
	For Aluminum Pistons (††)	--	--	1	--	--	--	1	--	1660	Present	KT372
	For Aluminum Pistons (††)	--	--	--	1	--	--	--	--	1660	Present	KT373
	For Aluminum Pistons (††)	--	--	--	--	1	--	--	1	0	Present	KT375
	For Aluminum Pistons (††)	--	--	--	--	--	1	--	--	0	Present	KT376
229†	Crankshaft (1000RPM) (w/oilway plug)											
	For Aluminum Pistons (††)	1	--	--	--	--	--	--	--	3068	Present	KT370
	For Aluminum Pistons (††)	--	1	--	--	--	--	--	--	3068	Present	KT371
	For Aluminum Pistons (††)	--	--	1	--	--	--	1	--	3068	Present	KT372
	For Aluminum Pistons (††)	--	--	--	1	--	--	--	--	3068	Present	KT373
	For Aluminum Pistons (††)	--	--	--	--	1	--	--	1	0	Present	KT375
	For Aluminum Pistons (††)	--	--	--	--	--	1	--	--	0	Present	KT376
229A	Plug, Pipe, 1/8", Hex Socket Head (N.S.)	5	5	5	5	8	8	5	8	0	Present	13163A

NOTE:

- * This bearing is interchangeable with the bearing (Part No. A31988A) originally used on the 2, 4, 6 and 8 cylinder compressors. A spacer is incorporated as an integral part of this bearing, eliminating the use of shims and a bearing lock. When installing this bearing, do not use the shims (Item No. 230) and bearing lock (Item No. 226).
- + All 1200 RPM VMC Compressors with Serial No. 1660 and above have aluminum pistons. All other 1200 RPM VMC Compressors with serial numbers 1659 and below have cast iron pistons. If it is desired to change from cast iron pistons to aluminum pistons, it is absolutely necessary to change the crankshaft.
- ++ When ordering a crankshaft bearing locknut (Item 224) for a compressor with Serial No. 9,999 and below, also order crankshaft bearing lockwasher (Item 225). See page 31.
- † When ordering bare crankshaft for a compressor with Serial No. 9999 and below, also order Item 224, crankshaft bearing locknut and retaining compound kit.
- †† Supplied as a kit, includes retaining compound for bearing locknut. Retaining compound also available separately; order Part No. KT365.
- N.S. = Not Shown.

VILTER MANUFACTURING CORPORATION

440 VMC COMPRESSORS

February 2001
Replaces
August 1982

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS

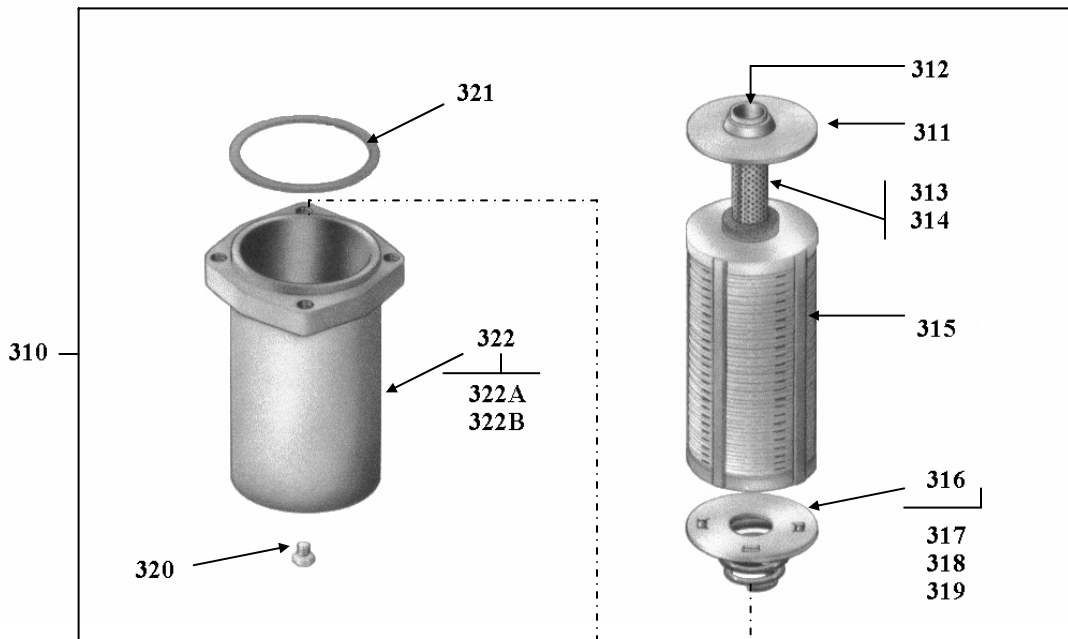
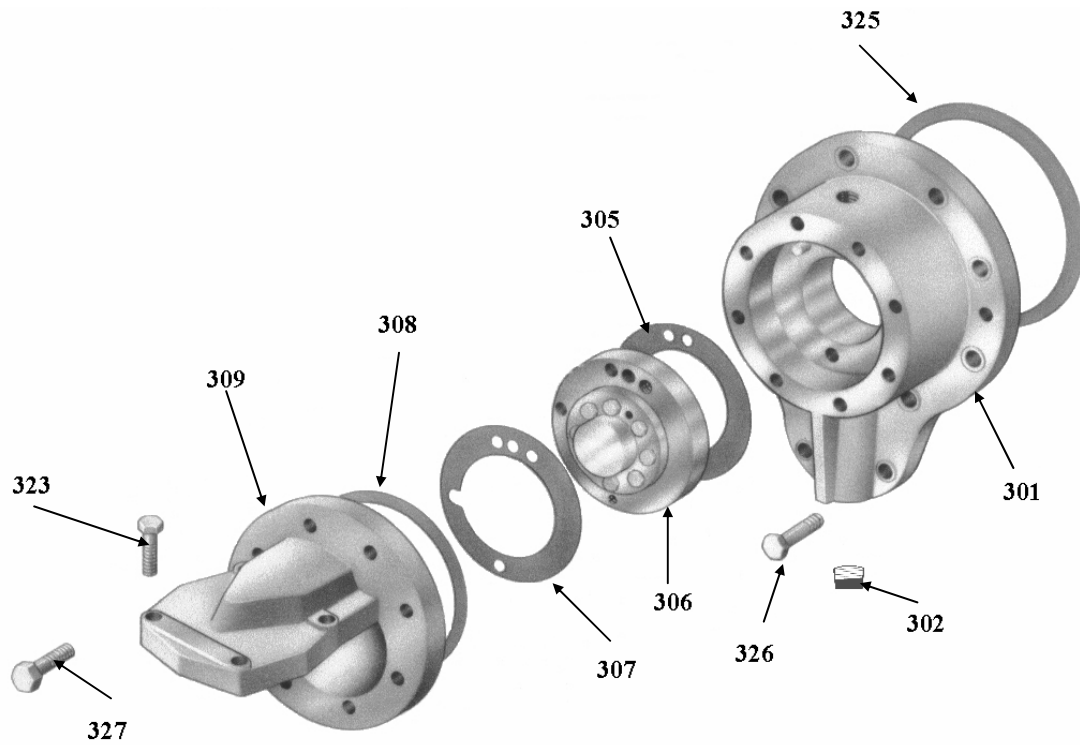
ITEM	DESCRIPTION NO. OF CYL.	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO- STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
231	Retainer, Rear Bearing †	1	1	1	1	1	1	1	1	0	Present	31904A
231A 231B	Rear Bearing and Lock Pin Kit	1	1	1	1	1	1	1	1	0	Present	KT353
231A 231B	Pin, Bearing Lock + Bearing, Rear Crankshaft	1 1	1 1	1 1	1 1	1 1	1 1	1 1	1 1	4233 0	Present Present	33678A A33509A
232	Screw, ⁵ / ₁₆ " x 1" Hex. Socket Head Cap	4	4	4	4	4	4	4	4	See		13160D
232	Screw, ⁵ / ₁₆ " x 1½" Hex. Head Cap.	4	4	4	4	4	4	4	4	Note †		1736G
233	Crank, Oil Pump Drive	1	1	1	1	1	1	1	1	0	Present	33403A
234	Cap, Bearing Support *	--	--	--	--	1	1	--	1	0	Present	*
235	Pin, ¼" x 1" Dowel *	--	--	--	--	2	2	--	2	0	Present	13162X
236	Bolt, ½" x 1¾" Machine	--	--	--	--	4	4	--	4	0	Present	11396D
237	Bearing Half, Upper Right or Lower Left	--	--	--	--	2	2	--	2	0	Present	33508A
238	Bearing Half, Upper Left or Lower Right	--	--	--	--	2	2	--	2	0	Present	33508B
239	Oil Dam, Center Bearing ††	--	--	--	--	2	2	--	2	0	Present	33498A
240	Pin, Threaded Taper	--	--	--	--	1	1	--	1	0	Present	33497A
241	Case, Bearing Support *	--	--	--	--	1	1	--	1	0	Present	*
242	Washer, ½" Spring Lock	--	--	--	--	4	4	--	4	0	Present	13165F
243	Nut, ½" Hex	--	--	--	--	4	4	--	4	0	Present	1726E
244	Nut, ⁹ / ₁₆ " Hex	--	--	--	--	1	1	--	1	0	Present	13253F
245	Screw, ¼" x ½" Hex. Head Cap ††	--	--	--	--	8	8	--	8	0	Present	2796AC
246	Key, Crankshaft	1	1	1	1	--	--	1	--	0	Present	31994B
246	Key, Crankshaft	--	--	--	--	1	1	--	1	0	Present	33505B
247	Screw, Flywheel Hub	1	1	1	1	1	1	1	1	0	Present	31956A
248	Washer, Flywheel Hub Screw	--	--	--	--	1	1	--	1	0	Present	33495A

NOTES:

- * Matched set with pin, sold as assembly A32163A. Shown in three parts to illustrate disassembly.
- + A bearing lock pin (Item 231A) is used to keep outer face of bearing (Item 231B) from turning. If compressor does not have groove in bottom of rear bearing cover (Item 301), make a notch with a ¼" deep radius and 1⅞" long to accommodate pin in cover.
- † Mounting holes on retainer (Item 231) were changed from counterbored holes to plain, straight-thru holes. Use replacement screw, part number 13160D, on the former retainer with counterbored holes. Use replacement screw, part number 1736G, on current retainer with straight-thru holes.
- †† Dams (Item 239) and screws (Item 245) are not needed when using VILTER's patented joined crankshafts. In this design version (introduced in 1980) two 6 cylinder or two 8 cylinder crankshafts are joined by a sleeve to form an inseparable 12 cylinder or 16 cylinder crankshaft. This specially machined sleeve eliminates the dams. This design is completely interchangeable with the former design.
- ††† See page 9 for symbol regarding this information. Compressors below serial number 21355 were furnished with the no longer available front bearing cover assemblies A30294A (2,4,6, and 8 cylinders) or A32162A (12 and 16 cylinders), and front bearing retainer 31885A (2,4,6, and 8 cylinders) or 33500A (12 and 16 cylinders) without the oil hole. Former front bearing retainers (31885A or 33500A) without oil holes cannot be used with current front bearing cover assemblies A36240A (2,4,6, and 8 cylinders) and A36241A (12 and 16 cylinders), as there is no way for oil to get to the bearing. If front bearing cover is being replaced, a current front bearing retainer (31885A or 33500A with oil hole) must be ordered also, unless one of these current styles is already being used. If a current front bearing retainer, (31885A or 33500A, both with oil hole) is used with former style cover (A30294A or A32162A) having an oil hole, remove orifice in cover (A30294A or A32162A) and replace with solid 1⅞" pipe plug.

440 VMC COMPRESSORS

REAR BEARING COVER REPLACEMENT PARTS
Compressors with Standard Tri-Micro® Filter
FIGURE 6



* **DO NOT DISASSEMBLE CENTER TUBE -
FACTORY PRESET RELIEF VALVE**

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
July 1986

440 VMC COMPRESSORS

REAR BEARING COVER REPLACEMENT PARTS (Compressors With Standard Tri-Micro® Filter)

ITEM	DESCRIPTION NO. OF CYL.	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO- STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
301 Thru 304	Rear Bearing Cover Assembly Kit	1	1	1	1	1	1	1	1	0	Present	KT092
301	Cover, Rear Bearing	1	1	1	1	1	1	1	1	0	Present	**
302	Plug, ¾" Hex. Socket Head Pipe	1	1	1	1	1	1	1	1	0	Present	13163E
303	Pin, ⅜" x 1" Dowel (not shown)	1	1	1	1	1	1	1	1	0	Present	2868H
304	Orifice, Oil Metering (not shown)	1	1	1	1	1	1	1	1	0	Present	33361A
305	Gasket, Oil Pump body	1	1	1	1	1	1	1	1	0	Present	31899A
306	Oil Pump Assembly	1	1	1	1	1	1	1	1	0	Present	A33480A
307 Thru 324	Conversion Kit, Std. Tri-Micro	1	1	1	1	1	1	1	1	0	13374	KT361A & B +
307	Gasket, Oil Pump Cover	1	1	1	1	1	1	1	1	0	Present	31900A
308	Gasket, Oil Pump and Rear Bearing Cover Seal	1	1	1	1	1	1	1	1	13375	Present	33320A
309	Cover, Oil Pump and Filter Head (Used when Oil Cooler not used)	1	1	1	1	1	1	1	1	13375	Present	36190A
309	Cover, Oil Pump and Filter Head (Used when Oil Cooler is used)	1	1	1	1	1	1	1	1	13375	Present	34759A
310	Filter Assy, Complete (Tri-Micro) (Items 311 thru 322B)	1	1	1	1	1	1	1	1	13375	Present	A35240A
311, 312, 313 & 314	Spool – Strainer Tube Assembly	1	1	1	1	1	1	1	1	13375	Present	1448U
311, 312 thru 314 & 315 thru 319 &321	Filter Assembly (<u>without</u> shell)	1	1	1	1	1	1	1	1	13375	Present	1448T
311	Spool Assembly (with bypass relief)	1	1	1	1	1	1	1	1	13375	Present	1448J
312	Seal, Spool End	1	1	1	1	1	1	1	1	13375	Present	1448H
313	Strainer Tube	1	1	1	1	1	1	1	1	13375	Present	1448K
314	Ring, Retaining	1	1	1	1	1	1	1	1	13375	Present	1448L
315	Recharge (Gasket 1448B included)	1	1	1	1	1	1	1	1	13375	Present	1448C
316	Pressure Plate Assembly (Items 317, 318 and 319)	1	1	1	1	1	1	1	1	13375	Present	1448M
317	Pressure Plate	1	1	1	1	1	1	1	1	13375	Present	1448N
318	'O' Ring Seal, Pressure Plate	1	1	1	1	1	1	1	1	13375	Present	1448P
319	Spring, Pressure Plate	1	1	1	1	1	1	1	1	13375	Present	1448Q
320	Plug, Steel Square Head Pipe, 1/8"	1	1	1	1	1	1	1	1	13375	Present	13264A
321	Gasket, Oil Filter Head	1	1	1	1	1	1	1	1	13375	Present	1448B
322	Filter Shell with Flange and Plug (Items 320, 322A and 322B)	1	1	1	1	1	1	1	1	13375	Present	A34623A
322A	Flange, Oil Filter Tank	1	1	1	1	1	1	1	1	13375	Present	35125A
322B	Tank, Oil Filter	1	1	1	1	1	1	1	1	13375	Present	34623A
323	Screw, Hex. Head Cap 7/16" x 2"	4	4	4	4	4	4	4	4	13375	Present	1689G
324	Instruction/Name Plate (not shown)	1	1	1	1	1	1	1	1	13375	Present	40680AT
325	Gasket, Bearing Cover	1	1	1	1	1	1	1	1	0	Present	31890A
326	Screw, 5/8" x 2" Hex. Head Cap	10	10	10	10	10	10	10	10	0	Present	13152E
327	Screw, ½" x 1¼"Hex Head Cap	8	8	8	8	8	8	8	8	0	Present	2796EL

NOTES:

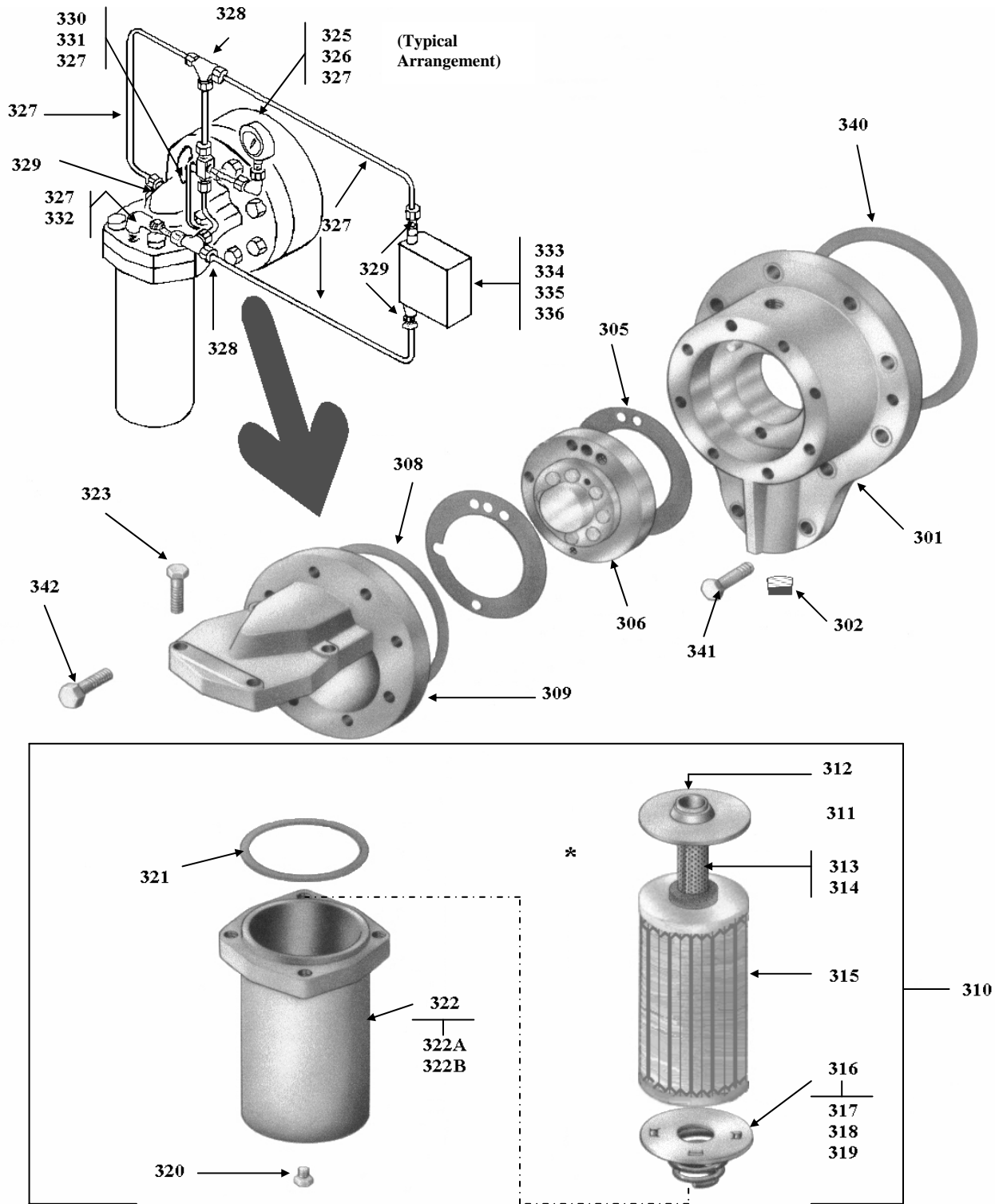
A. "Tri-Micro" is a registered trademark of Vilter Manufacturing Corporation.

** The rear bearing cover is sold only in Kit KT092.

+ When Kit KT256 is ordered, the overall length of the existing oil pump (Item 306) on the compressor should be checked. If the length from the end of the pump shaft to the end of the pump boss measures 5 7/32", a new oil pump must be ordered with Kit KT256.

440 VMC COMPRESSORS

REAR BEARING COVER REPLACEMENT PARTS
Compressors With Special (Improved) Tri-Micro® Filter Option
FIGURE 7



* DO NOT DISASSEMBLE CENTER TUBE -
FACTORY PRESET RELIEF VALVE

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
February 1984

440 VMC COMPRESSORS
REAR BEARING COVER REPLACEMENT PARTS
Compressors With Special (Improved) Tri-Micro® Filter Option

ITEM	DESCRIPTION	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO-STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
	NO. OF CYL.											
301 thru 304	Rear Bearing Cover Assembly Kit	1	1	1	1	1	1	1	1	0	Present	KT092
301	Cover, Rear Bearing	1	1	1	1	1	1	1	1	0	Present	**
302	Plug, ¾" Hex Socket Head Pipe	1	1	1	1	1	1	1	1	0	Present	13163E
303	Pin, ⅝" x 1" Dowel (not shown)	1	1	1	1	1	1	1	1	0	Present	2868H
304	Orifice, Oil Metering (not shown)	1	1	1	1	1	1	1	1	0	Present	33361A
305	Gasket, Oil Pump Body	1	1	1	1	1	1	1	1	0	Present	31899A
306	Oil Pump Assembly	1	1	1	1	1	1	1	1	0	Present	A33480A
307	Conversion Kit, Special (improved)	1	1	1	1	1	1	1	1	0	Present	KT361A +
Thru 339	Tri-Micro Oil Filter, 120 volts	1	1	1	1	1	1	1	1	0	Present	KT361B +
	Conversion Kit, Special (improved)	1	1	1	1	1	1	1	1			
	Tri-Micro Oil filter, 240 volts											
307	Gasket, Oil Pump Cover	1	1	1	1	1	1	1	1	0	Present	31900A
308	Gasket, Oil Pump and Rear Bearing	1	1	1	1	1	1	1	1	0	Present	33320A
	Cover Seal											
309	Cover, Oil Pump and Filter Head	1	1	1	1	1	1	1	1	0	Present	34565A
310	Filter Assembly, Complete (Tri-Micro)	1	1	1	1	1	1	1	1	0	Present	A35241A
311	Spool Assembly (without bypass relief)	1	1	1	1	1	1	1	1	0	Present	2046A
312	Seal, Spool End	1	1	1	1	1	1	1	1	0	Present	1448H
313	Strainer Tube	1	1	1	1	1	1	1	1	0	Present	1448K
314	Ring, Retaining	1	1	1	1	1	1	1	1	0	Present	1448L
315	Recharge (Gasket 1448B included)	1	1	1	1	1	1	1	1	0	Present	2115C
316	Pressure Plate Assembly	1	1	1	1	1	1	1	1	0	Present	1448M
317	Pressure Plate	1	1	1	1	1	1	1	1	0	Present	1448N
318	'O' Ring Seal, Pressure Plate	1	1	1	1	1	1	1	1	0	Present	1448P
319	Spring, Pressure Plate	1	1	1	1	1	1	1	1	0	Present	1448Q
320	Plug, Steel Square Head Pipe ⅛"	1	1	1	1	1	1	1	1	0	Present	1190A
321	Gasket, Oil Filter Head	1	1	1	1	1	1	1	1	0	Present	1448B
322	Filter Shell with Bolt Ring	1	1	1	1	1	1	1	1	0	Present	A34623A
323	Screw, Hex Head Cap 7/16" x 2"	4	4	4	4	4	4	4	4	0	Present	1689G
324	Instruction/Nameplate	1	1	1	1	1	1	1	1	0	Present	40680AJ
325	Gauge, 2½", 0-300 PSI, Oil Filter	1	1	1	1	1	1	1	1	0	Present	2047A
326	Elbow, ¼" 90° Female Compression	1	1	1	1	1	1	1	1	0	Present	1892B
327	Tubing, ¼" O.D. x 5 ft. Steel	AR	AR	AR	AR	AR	AR	AR	AR	0	Present	S1589A
328	Tee, ¼" Compression	2	2	2	2	2	2	2	2	0	Present	13239C
329	Connector, ¼"MPT X ¼"O.D. Compression	3	3	3	3	3	3	3	3	0	Present	13229D
330	Valve, 3-Way, Oil Filter	1	1	1	1	1	1	1	1	0	Present	2030A
331	Bracket, Valve	1	1	1	1	1	1	1	1	0	Present	35106A
332	Elbow, ¼" 90° Male Compression	1	1	1	1	1	1	1	1	0	Present	13375D
333	Control, Pressure Differential	1	1	1	1	1	1	1	1	0	Present	1643V
334	Screw, 10-32 x ⅜" Long, Round Head	2	2	2	2	2	2	2	2	0	Present	1332C
335	Washer, Lock, ⅜16"	2	2	2	2	2	2	2	2	0	Present	13165A
336	Washer, Flat, ⅜16"	4	4	4	4	4	4	4	4	0	Present	13265A
337 *	Cover, Crankcase Handhole	1	1	1	1	1	1	1	1	0	Present	A33034L
338 *	Thermometer, Crankcase Oil	1	1	1	1	1	1	1	1	0	Present	1467F
339 *	Heater, 535W, 115V Electric Crankcase	1	1	1	1	1	1	1	1	0	Present	2069J
339 *	Heater, 535W, 230V Electric Crankcase	1	1	1	1	1	1	1	1	0	Present	2069K
340	Gasket, Bearing Cover	1	1	1	1	1	1	1	1	0	Present	31890A
341	Screw, ⅝" x 2" Hex Head Cap	10	10	10	10	10	10	10	10	0	Present	13152E
342	Screw, ½" x 1¾" Hex Head Cap	8	8	8	8	8	8	8	8	0	Present	2796EL

NOTES:

AR = As required. Cut to suit when assembling.

- Not shown here, cover replaces item 123. Thermometer and heater mount on crankcase handhole cover so oil temperature can be monitored and raised to 100°F (thermostat setting) before starting compressor. If an attempt is made to start with cold oil, the filter pressure differential switch will stop compressor.

** The rear bearing cover is sold only in Kit KT092.

+ When Kit KT361A & B is ordered, the overall length of the existing oil pump (Item 306) on the compressor should be checked. If the length from the end of the pump shaft to the end of the pump boss measures 5 7/32", a new oil pump must be ordered with Kit KT361A & B.

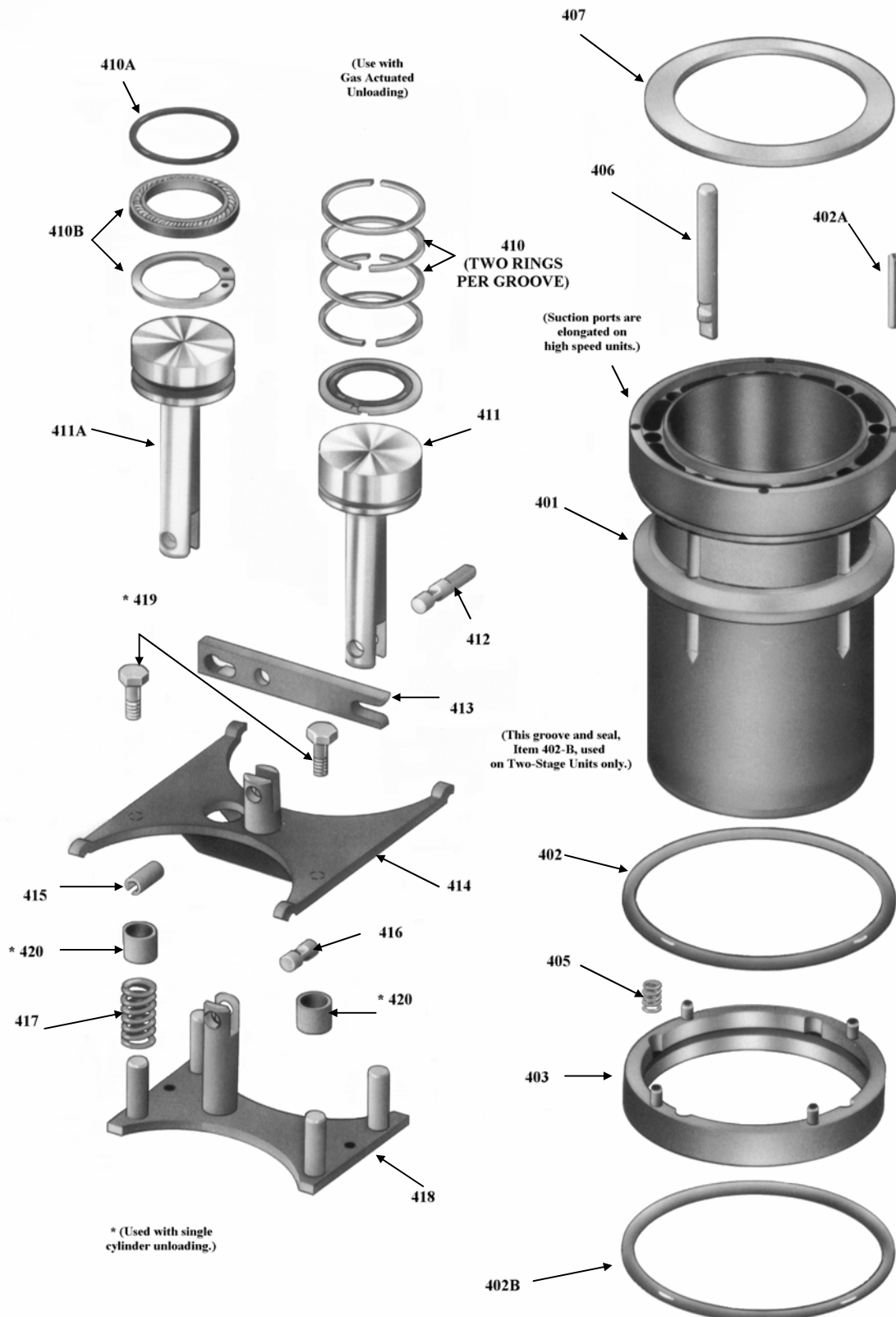
February 2001
Replaces
February 1984

VILTER MANUFACTURING CORPORATION

SECTION 105-R
PAGE 16

440 VMC COMPRESSORS

CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS FIGURE 8



440 VMC COMPRESSORS**CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS**

1200 RPM HIGH STAGE AND TWO-STAGE COMPRESSORS (Serial Number 3638 to as indicated) **

ITEM	DESCRIPTION	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO-STAGE		FROM	THRU	
		NO. OF CYL.										
		2	4	6	8	12	16	6	12			
401	Cylinder Liner Kit (w/Unload-Std.)	1*	2	4	4	8	8	--	--	3638	Present	KT072
Thru	Cylinder Liner Assy (w/Unload-Hi Suct #)	--	2	4	4	8	8	--	--	3638	Present	A31194B
406	Cylinder Liner Kit (w/Unloading)	--	--	--	--	--	--	3*	6*	3638	14203	KT072
	Cylinder Liner Assy (w/Unloading)	--	--	--	--	--	--	3*	6*	14204	Present	A33179B
401	Cylinder Liner Kit (w/o Unloading)	2	2	2	4	4	8	--	--	3638	Present	KT071
Thru	Cylinder Liner Kit (w/o Unloading)	--	--	--	--	--	--	6	12	3638	14203	KT071
402A	Cylinder Liner Kit (w/o Unloading)	--	--	--	--	--	--	3*	6*	3638	14203	KT071
	Cylinder Liner Kit (w/o Unloading)	1*	--	--	--	--	--	--	--	3638	Present	KT071
401	Cylinder Liner Assy (w/o Unloading)	--	--	--	--	--	--	6	12	14204	Present	A33179A
Thru	Cylinder Liner Assy (w/o Unloading)	--	--	--	--	--	--	3*	6*	14204	Present	A33179A
401	Liner, Cylinder	2	4	6	8	12	16	--	--	3638	Present	32687A
401	Liner, Cylinder	--	--	--	--	--	--	6	12	3638	14203	32687A
401	Liner, Cylinder	--	--	--	--	--	--	6	12	14204	Present	33179A
402	Seal, 'O' Ring (Upper)	2	4	6	8	12	16	6	12	3638	Present	2176BH
402A ++	Pin, Roll	8	16	24	32	48	64	24	48	7000	Present	1193Q
402B	Seal, 'O' Ring (Lower)	--	--	--	--	--	--	6	12	14204	Present	2176BL
402	Lift Ring & Post Assy (Std)	1*	2	4	4	8	8	3*	6*	3638	Present	A33351A
403	Lift Ring & Post Assy (Hi-Suct #)	--	2	4	4	8	8	--	--	3638	Present	A33351A
405	Spring, Lift	4*	8	16	16	32	32	12*	24*	3638	Present	33352A
406	Pin, Lift	4*	8	16	16	32	32	12*	24*	3638	Present	33350A
407	Plate, Suction Valve	2	4	6	8	12	16	6	12	3638	Present	31909A
410B												
411A & 412	Piston Kit, Cap. Red. (Oil Actuated+)	1*	1	2	2	4	4	3*	6*	19247	22799	KT364
410, 411 & 412	Piston Kit, Cap. Red. (Gas Actuated+)	1*	1	2	2	4	4	3*	6*	3638 30000	19246 32499	KT034
410	Piston Ring (Steel-For Gas Actuated)	4*	4	8	8	16	16	12*	24*	30000	32499	31989L
410A	'O' Ring (Rubber-For 0.187" Groove)	1*	1	2	2	4	4	3*	6*	19247	22673	2176AX
410B	Ring Set (PTFE-For 0.120" Groove)	1*	1	2	2	4	4	3*	6*	22674	22799	2557A
411/411 A	Piston, Unloader (Gas or Oil)	1*	1	2	2	4	4	3*	6*	---	---	Order Kit
412	Pin, Long Pivot	1*	1	2	2	4	4	3*	6*	3638	22799	33250C
413	Cap Cont Mech Assy (Std-Single) +	1*	--	--	--	--	--	3*	6*	150	22799	A33577A
Thru	Cap Cont Mech Assy (Std-Double) +	--	1	2	2	4	4	--	--	150	22799	A33354A
420	Cap Cont Mech Assy (Hi-Suct #) +	--	1	2	2	4	4	--	--	150	22799	A35253A
413	Arm, Yoke Lifting	1*	1	2	2	4	4	3*	6*	150	22799	33338A
414	Yoke Assembly (Std-Single)	1*	--	--	--	--	--	3*	6*	150	22799	A33575A
414	Yoke Assembly (Std-Double & Hi Suct)	--	1	2	2	4	4	--	--	150	22799	A33335A
415	Pin, ³ / ₈ " x ¹¹ / ₁₆ " lg. Roll	1*	1	2	2	4	4	3*	6*	150	22799	1193X
416	Pin, Short Pivot	1*	1	2	2	4	4	3*	6*	30000	32499	33250B
417 ***	Spring, Unloader Yoke (Std)	4*	4	8	8	16	16	12*	24*	30000	32499	33686A
417	Spring, Unloader Yoke (Hi-Suct #)	6	6	12	12	24	24	--	--	30000	32499	33686A
418	Yoke Guide Assembly (std-single)	1*	--	--	--	--	--	3*	6*	30000	32499	A33576A
418	Yoke Guide Assembly (std-double)	--	1	2	2	4	4	--	--	30000	32499	A33347A
418	Yoke Guide Assembly (Hi Suct #)	--	1	2	2	4	4	--	--	30000	32499	A35248A
419	Screw, ³ / ₈ " x 1" Cap Lock	2*	--	--	--	--	--	6*	12*	30000	32499	1352D
420	Spacer, Sleeve	2*	--	--	--	--	--	6*	12*	30000	32499	33618A

NOTES:

* These items are used on Two-Stage and 2 cylinder compressors only when equipped with unloading. For single cylinder unloading, the yoke assembly (Item 414) and the two pins on the yoke guide assembly (Item 418) have drilled and tapped holes to accommodate screws (Item 419) and spacers (Item 420).

** Replacement parts for 1200 RPM compressors with serial numbers below 3638 are on pages 25 and 26.

*** Spring part number was 33353A and quantity was 6. Replace all springs in the assembly.

+ Actuation type can be determined by checking unloading solenoid valve – oil uses three-way valves, gas uses two-way valves. For serial numbers above these, see page 19.

++ Four "roll pin" holes are drilled thru the safety head and safety head yoke into the cylinder liner. Drilled replacement parts are interchangeable with undrilled parts. Discard roll pins from kits if new liner is used with former style safety head, safety head yoke and frame with built-in guide lugs.

High suction compressors are identified by an "X" in the serial number.

February 2001

VILTER MANUFACTURING CORPORATION

SECTION 105-R

Replaces

PAGE 18

March 1985

440 VMC COMPRESSORS

**CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
1000 RPM HIGH STAGE AND TWO-STAGE COMPRESSORS AND 1200 RPM BOOSTER
COMPRESSORS**

ITEM	DESCRIPTION	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO-STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
	NO. OF CYL.											
401	Cylinder Liner Kit (w/unloading)	1*	2	4	4	--	--	--	--	0	Present	KT072
Thru	Cylinder Liner Kit (w/unloading)	--	--	--	--	8	8	--	--	0	Present	KT033
406	Cylinder Liner Kit (w/unloading)	--	--	--	--	8	8	--	--	2656	Present	KT072
	Cylinder Liner Kit (w/unloading)	--	--	--	--	--	--	3*	6*	0	14203	KT072
	Cylinder Liner Kit (w/unloading)	--	--	--	--	--	--	3*	6*	14204	Present	A33179B
401	Cylinder Liner Kit (w/o unloading)	2	2	2	4	--	--	--	--	0	Present	KT071
Thru	Cylinder Liner Kit (w/o unloading)	--	--	--	--	4	8	--	--	2656	Present	KT071
402A	Cylinder Liner Kit (w/o unloading)	1*	--	--	--	--	--	--	--	0	Present	KT071
	Cylinder Liner Kit (w/o unloading)	--	--	--	--	--	--	3*	6*	0	14203	KT071
	Cylinder Liner Kit (w/o unloading)	--	--	--	--	--	--	6	12	0	14203	KT071
401	Cylinder Liner Assy (w/o unloading)	--	--	--	--	--	--	3*	6*	14204	Present	A33179A
Thru 402B	Cylinder Liner Assy (w/o unloading)	--	--	--	--	--	--	6	12	14204	Present	A33179A
401	Liner, Cylinder	2	4	6	8	--	--	--	--	0	Present	32687A
401	Liner, Cylinder	--	--	--	--	12	16	--	--	0	2655	A32609A
401	Liner, Cylinder	--	--	--	--	12	16	--	--	2656	Present	32687A
401	Liner, Cylinder	--	--	--	--	--	--	6	12	0	14203	32687A
401	Liner, Cylinder	--	--	--	--	--	--	6	12	14204	Present	33179A
402	Seal, 'O' Ring (upper)	2	4	6	8	12	16	6	12	0	Present	2176BH
402A++	Pin, Roll	8	16	24	32	48	64	24	48	7000	Present	1193Q
402B	Seal, 'O' Ring (Lower)	--	--	--	--	--	--	6	12	14204	Present	2176BL
403	Lift Ring & Spring Post Assembly	1*	2	4	4	--	--	3*	6*	160†	Present	A33351A
403	Lift Ring & Spring Post Assembly	--	--	--	--	8	8	--	--	2656	Present	A33351A
405	Spring, Lift	4*	8	16	16	--	--	12*	24*	160†	Present	33352A
405	Spring, Lift	--	--	--	--	16	16	--	--	0	2655	33428A
405	Spring, Lift	--	--	--	--	32	32	--	--	2656	Present	33352A
406	Pin, Lift	4*	8	16	16	--	--	12*	24)	150†	Present	33350A
406	Pin, Lift	--	--	--	--	32	32	--	--	2656	Present	33350A
407	Plate, Suction Valve	2	4	6	8	--	--	6	12	0	Present	31909A
407	Plate, Suction Valve	--	--	--	--	12	16	--	--	0	2655	33422A
407	Plate, Suction Valve	--	--	--	--	12	16	--	--	2656	Present	31909A
408	Springs, Valve (Helical) (not shown)	--	--	--	--	48	64	--	--	0	2655	33803A
410B												
411A	Piston Kit, Cap Red (Oil Actuated+)	1*	1	2	2	4	4	3*	6*	19247	22799	KT364
412												
410	Piston Kit, Cap Red (Gas Actuated+)	1*	1	2	2	4	4	3*	6*	150†	19246	KT034
411										30000	32499	
412												
410	Piston Ring (Steel-for gas actuated)	4*	4	8	8	16	16	12*	24*	30000	32499	31989L
410A	'O' Ring (Rubber-for 0.187" Groove)	1*	1	2	2	4	4	3*	6*	19247	22673	2176AX
410B	Ring Set (PTFE-for 0.120" Groove)	1*	1	2	2	4	4	3*	6*	22674	22799	2557A
411/411A	Piston, Unloader (gas or oil)	1*	1	2	2	4	4	3*	6*	---	---	Order Kit
412	Pin, Long Pivot	1*	1	2	2	4	4	3*	6*	150†	22799	33250C
413 thru	Capacity Control Mechanism Assembly	1*	--	--	--	--	--	3*	6*	150†	22799	A33577A
420	Capacity Control Mechanism Assembly	--	1	2	2	4	4	--	--	150†	22799	A33354A
413	Arm, Yoke Lifting	1*	1	2	2	4	4	3*	6*	150†	22799	33338A
414	Yoke Assembly	1*	--	--	--	--	--	3*	6*	150†	22799	A33575A
414	Yoke Assembly	--	1	2	2	4	4	--	--	150†	22799	A33335A
415	Pin, 3/8" x 11/16" Ig. Roll	1*	1	2	2	4	4	3*	6*	150†	22799	1193X
416	Pin, Short Pivot	1*	1	2	2	4	4	3*	6*	30000	32499	33250B
417 ***	Spring, Unloader Yoke	4*	4	8	8	16	16	12*	24*	30000	32499	33686A
418	Yoke Guide Assembly	1*	--	--	--	--	--	3*	6*	30000	32499	A33576A
418	Yoke Guide Assembly	--	1	2	2	4	4	--	--	30000	32499	A33347A
419	Screw, 3/8" x 1" Cap Lock	2*	--	--	--	--	--	6*	12*	30000	32499	1352D
420	Spacer, Sleeve	2*	--	--	--	--	--	6*	12*	30000	32499	33618A

NOTES:

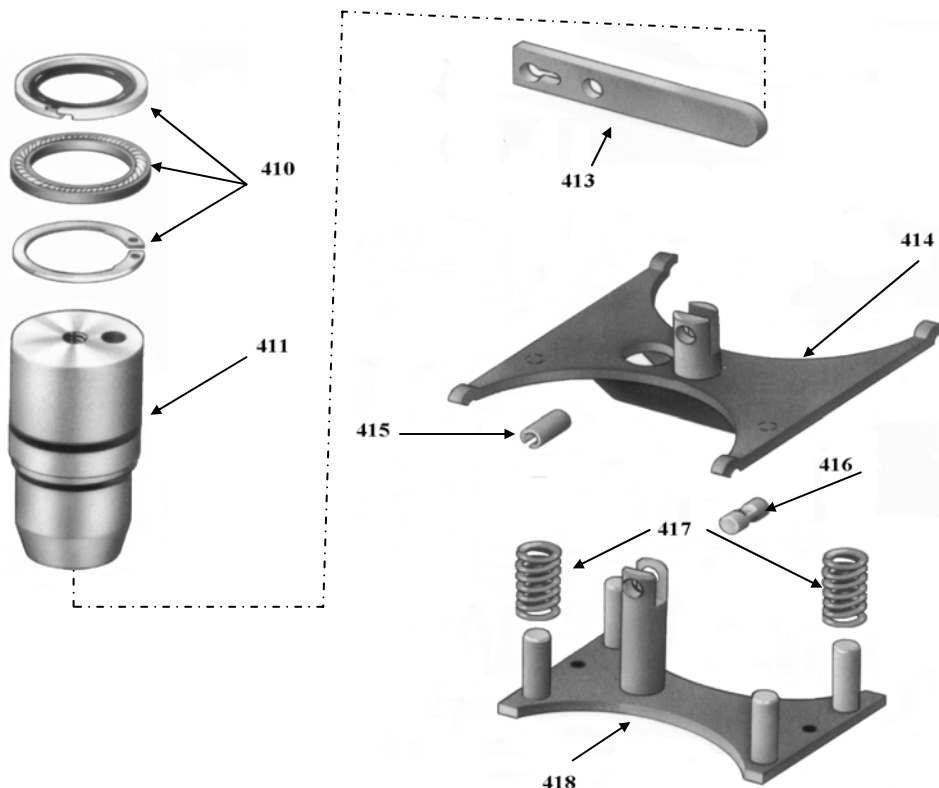
*, +, ++, or *** See note with same symbol on Page 17. ** See Pages 25 and 26 for illustration.

† Refer to Home Office for compressor with serial numbers below 150.

440 VMC COMPRESSORS

CAPACITY CONTROL MECHANISM ASSEMBLY (†) REPLACEMENT PARTS
Version used beginning with Serial Number: 32,500 for Gas Unloading
22,800 for Oil Unloading (++)

FIGURE 9



† Patents Pending.

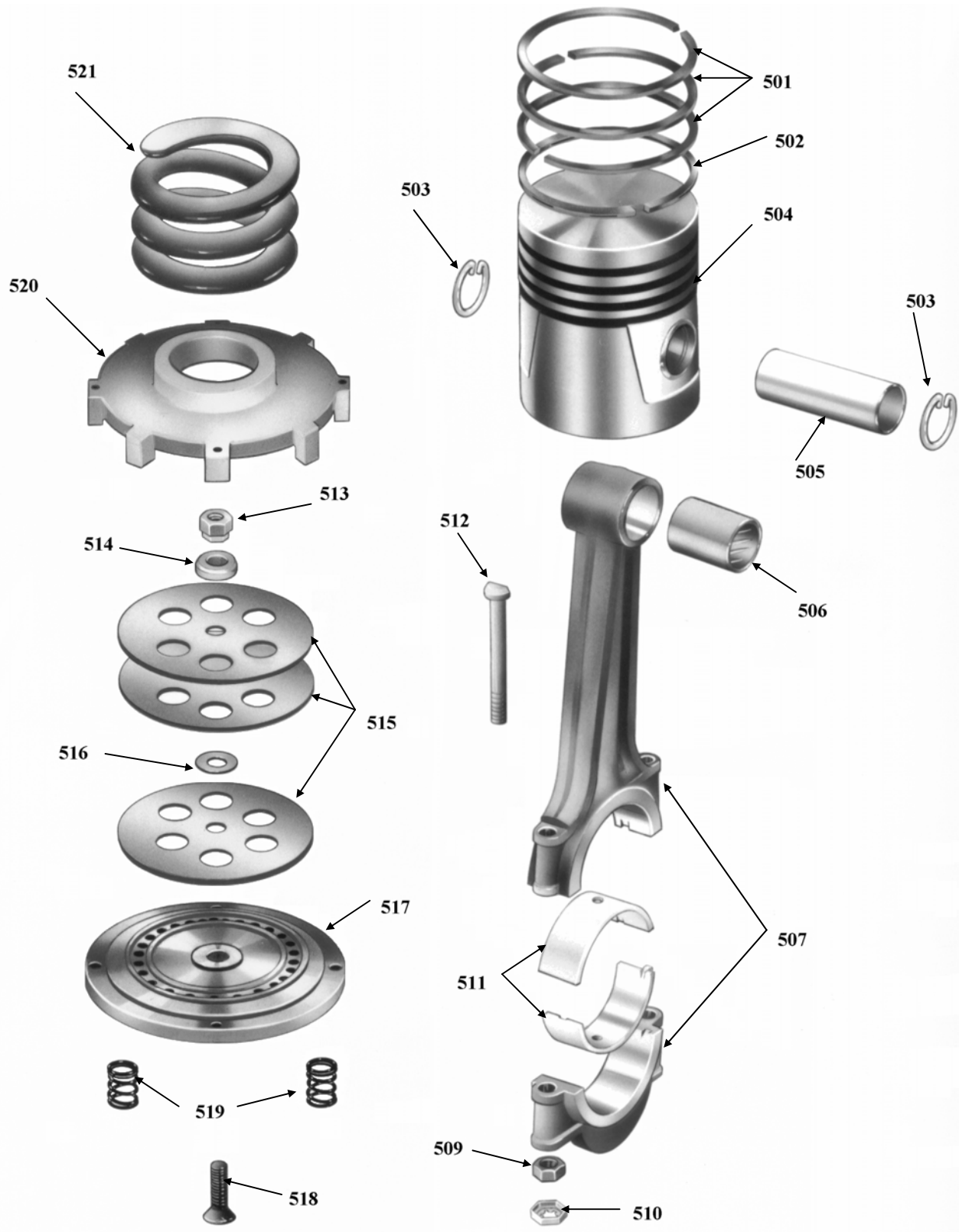
ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS						PART NUMBER
		2	4	6	8	12	16	
410 & 411	Piston & Rings Assy., Cap Red (Gas or Oil +)	-(1*)	1	2(3*)	2	4(6*)	4	A35315BX A35315CX
410	Ring Set (PTFE and rubber)	-(1*)	1	2(3*)	2	4(6*)	4	2557A
411	Piston, Unloader (Gas or Oil)	-(1*)	1	2(3*)	2	4(6*)	4	Order Assy
413 Thru 420	Complete Cap Control Mech Assy (Standard – Single Cylinder) (Standard – Double Cylinder) (High Suction – Single Cylinder) (High Suction – Double Cylinder)	-(1*) -- -(1*) --	-- 1 -- 1	-(3*) 2 -(3*) 2	-- 2 -- 2	-(6*) 4 -(6*) 4	-- 4 -- 4	A41787AX A41788BX A35305AX A35304AX
413	Arm, Yoke Lifting	-(1*)	1	2(3*)	2	4(6*)	4	41725A
414	Yoke Assy (Standard – Single Cylinder)	-(1*)	--	-(3*)	--	-(6*)	--	A33575A
414	Yoke Assy (Standard – Double Cylinder)	--	1	2	2	4	4	A33335A
414	Yoke Assy (High Suct-Single Cylinder)	-(1*)	--	-(3*)	--	-(6*)	--	A35247A
414	Yoke Assy (High Suct-Double Cylinder)	--	1	2	2	4	4	A33335A
415	Pin, $\frac{3}{8}$ " x $\frac{11}{16}$ " lg. Roll	-(1*)	1	2(3*)	2	4(6*)	4	1193X
416	Pin, Short Pivot	-(1*)	1	2(3*)	2	4(6*)	4	33250B
417	Spring, Unloader Yoke (Standard)	-(4*)	4	8(12*)	8	16(24*)	16	33686A
417	Spring, Unloader Yoke (High Suction)	-(6*)	6	12(18*)	12	24(36*)	24	33686A
418	Yoke Guide Assy (Std-Single Cylinder)	-(1*)	--	-(3*)	--	-(6*)	--	A33576A
418	Yoke Guide Assy (Hi Suct-Single Cyl)	-(1*)	--	-(3*)	--	-(6*)	--	A35249A
418	Yoke Guide Assy (Hi Suct-Double Cyl)	--	1	2	2	4	4	A35248A
419	Screw, $\frac{9}{16}$ " x 1" Cap Lock	-(2*)	--	-(6*)	--	-(12*)	--	1352D
420	Spacer, Sleeve	-(2*)	--	-(6*)	--	-(12*)	--	33618A

NOTES:

*, +, ++ See pages 16, 17, 18, 25 and 26 for notes and lower serial number applications.

440 VMC COMPRESSORS

PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS
FIGURE 10



VILTER MANUFACTURING CORPORATION

February 2001
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February 1985

440 VMC COMPRESSORS

PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS
1200 RPM High Stage and Two-Stage Compressors
Serial Number 3638 to Present

ITEM	DESCRIPTION NO. OF CYL.	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO- STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
501 thru 505	Piston (Flat, AL) Rings and Pin Kit	2	4	6	8	12	16	6	12	3638	Present	KT213
501 thru 512	Piston (Flat, AL) & Connecting Rod Assembly Kit	2	4	6	8	12	16	6	12	3638	Present	KT478
501	Piston Ring, Compression	6	12	18	24	36	48	18	36	3638	Present	31989M
502	Piston Ring, Oil	2	4	6	8	12	16	6	12	3638	Present	31989N **
503	Snap Ring, Piston Pin	4	8	12	16	24	32	12	24	3638	Present	33244A
504 & 505	Piston and Pin Assembly	2	4	6	8	12	16	6	12	3638	Present	Order Kit
506 thru 512	Connecting Rod Assembly with Bearings Kit	2	4	6	8	12	16	6	12	3638	Present	KT463
510 & 511	Bearing Half & Lock Nut Kit (std size)	2	4	6	8	12	16	6	12	3638	Present	KT512
	Bearing Half & Lock Nut Kit (undersize)	2	4	6	8	12	16	6	12	3638	Present	KT513
506	Bushing, Piston Pin	2	4	6	8	12	16	6	12	3638	Present	31896B #
507	Connecting Rod and Cap	2	4	6	8	12	16	6	12	3638	Present	Order Kit
509	Nut, Plain, Hex 3/8"-24UNF	4	8	12	16	24	32	12	24	3638	Present	2027A
510	Nut, Lock, 3/8"-24NF	4	8	12	16	24	32	12	24	3638	Present	2028A
510 & 511	Bearing Half, Conn Rod (w/o Groove)											
	Standard Size ++	4	8	12	16	24	32	12	24	3638	Present	KT512
	0.015" Undersize	4	8	12	16	24	32	12	24	3638	Present	KT513A
	0.030" Undersize	4	8	12	16	24	32	12	24	3638	Present	KT513
512	Bolt, Connecting Rod	4	8	12	16	24	32	12	24	3638	Present	31955A
513 Thru 518	Safety Head Assembly, Ammonia (for Helical Springs)	2	4	6	8	12	16	6	12	3638	Present	A32695C
	Safety Head Assembly, R12 and R22 (for Helical Springs)	2	4	6	8	12	16	6	12	3638	Present	A32695D
513	Nut, Lock, 3/8" Valve Retaining	2	4	6	8	12	16	6	12	3638	Present	1776B
514	Washer, Diaphragm Valve	2	4	6	8	12	16	6	12	3638	Present	31990B
515	Valve, Diaphragm Discharge	6	12	18	24	36	48	18	36	3638	Present	31939B
516	Spacer, Diaphragm Valve	2	4	6	8	12	16	6	12	3638	Present	31990A
517 †	Safety Head, Ammonia (for Helical Springs)	2	4	6	8	12	16	6	12	3638	Present	33531B
517 †	Safety Head, R12 and R22 (for Helical Springs)	2	4	6	8	12	16	6	12	3638	Present	33532B
518	Screw, Valve Retaining (60°)	2	4	6	8	12	16	6	12	3638	13,490	31964A
518 †	Screw, Valve Retaining (82°)	2	4	6	8	12	16	6	12	13491	Present	1527B
519	Springs, Valve (Helical)	8	16	24	32	48	64	24	48	3638	Present	33803A
520	Yoke, Safety Head	2	4	6	8	12	16	6	12	3638	Present	31941B
521	Spring, Safety Head	2	4	6	8	12	16	6	12	3638	Present	31882A

NOTES:

- * For replacement parts for compressors having serial numbers below 3638, see page 29.
- ** These oil rings do not require expanders. Do not use expanders. They may cause excessive wear.
- # Replacement bushing must be reamed after installation to properly accommodate piston pin.
- ++ Replaces bearing half with groove. If compressor has standard size bearings with groove, order 31957B-Std. Size bearing half. If crankshaft is groove undersize, order KT513 or KT513A bearing half set with locknuts with no groove.
- † When ordering safety head (Item 517) for machines with serial number below 13491 – Item 518 (1527B) must also be ordered. Screw hole was changed from a 60° hole to an 82° hole.

AL = Aluminum Pistons

February 2001

Replaces

February 1985

VILTER MANUFACTURING CORPORATION

SECTION 105-R

PAGE 22

440 VMC COMPRESSORS
PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS
1000 RPM HIGH STAGE AND TWO-STAGE COMPRESSORS,
AND 1200 RPM BOOSTER COMPRESSORS

ITEM	DESCRIPTION NO. OF CYL.	NO. REQ. PER COMPRESSOR								SERIAL NO.		
		SINGLE STAGE						TWO-STAGE		FROM	THRU	PART NUMBER
		2	4	6	8	12	16	6	12			
501 Thru 505	Piston (Flat,AL) Rings & Pin Kit Piston (Flat,AL), Rings & Pin Kit	2 --	4 --	6 --	8 --	-- 12	-- 16	6 --	12 --	3068 2656	Present Present	KT213 KT213
501 Thru 512	Piston (Flat,AL) & Conn Rod Assy Kit Piston (Flat,AL) & Conn Rod Assy Kit	2 --	4 --	6 --	8 --	-- 12	-- 16	6 --	12 --	3068 2656	Present Present	KT478 KT478
501 502 503	Piston Ring, Compression Piston Ring, Oil Snap Ring, Piston Pin	4 2 4	8 4 8	12 6 12	16 8 16	24 12 24	32 16 32	12 6 12	24 12 24	0 0 0	Present Present Present	31989M 31989N ** 33244A
506 Thru 512	Connecting Rod Assy with Bearings Kit	2	4	6	8	12	16	6	12	0	Present	KT463
510 & 511	Bearing Half & Lock Nut Kit (Std. Size) Bearing Half & Lock Nut Kit (Undersize)	2 2	4 4	6 6	8 8	12 12	16 16	6 6	12 12	0 0	Present Present	KT512 KT513
506 507 509 510 511	Bushing, Piston Pin Connecting Rod and Cap Nut, Plain, Hex 3/8"-24UNF Nut, Lock, 3/8" Connecting Rod Bearing Half, Conn. Rod (w/o Groove)	2 2 4 4	4 4 8 8	6 6 12 12	8 8 16 16	12 12 24 24	16 16 32 32	6 6 12 12	12 12 24 24	0 0 0 0	Present Present Present Present	31896B # Order Kit 2027A 2028A
512	Standard Size 0.015" Undersize 0.030" Undersize Bolt, Connecting Rod	4 4 4 4	8 8 8 8	12 12 12 12	16 16 16 16	24 24 24 24	32 32 32 32	12 12 12 12	24 24 24 24	0 0 0 0	Present Present Present Present	KT512 ++ KT513A KT513 ++ 31955A
513 Thru 518	Safety Head Assembly, Ammonia (for Helical Springs) (for Helical Springs)	2 --	4 --	6 --	8 --	-- 12	-- 16	6 --	12 --	2199+ 2656	Present Present	A32695C A32695C
513 Thru 518	Safety Head Assembly, R12 and R22 (for Helical Springs) (for Helical Springs)	2 --	4 --	6 --	8 --	-- 12	-- 16	6 --	12 --	2199+ 2656	Present Present	A32695D A32695D
513 513 514 514 515 515 516 516	Lock Nut, 3/8", Valve Retaining Lock Nut, 3/8", Valve Retaining Washer, Diaphragm Valve Washer, Diaphragm Valve Valve, Diaphragm Discharge Valve, Diaphragm Discharge Spacer, Diaphragm Valve Spacer, Diaphragm Valve	2 -- 2 -- 6 -- 2 --	4 -- 4 -- 12 -- 4 --	6 -- 6 -- 18 -- 6 --	8 -- 8 -- 24 -- 8 --	-- 12 -- 12 -- 36 --	-- 16 -- 16 -- 48 --	6 -- 6 -- 18 -- 6 --	12 -- 12 -- 36 --	0 2656 0 2656 0 2656 0 2656	Present Present Present Present Present Present Present Present	1776B 1776B 31990B 31990B 31939B 31939B 31990A 31990A
517 †	Safety Head (for Helical Springs) Ammonia	2	4	6	8	--	--	6	12	2199+	Present	33531B
517 †	Safety Head (for Helical Springs) Ammonia	--	--	--	--	12	16	--	--	2656	Present	33531B
517 †	Safety Head (for Helical Springs) R12 & R22	2	4	6	8	--	--	6	12	2199+	Present	33532B
517 †	Safety Head (for Helical Springs) R12 & R22	--	--	--	--	12	16	--	--	2656	Present	33532B
518 518 † 518 518 †	Screw, Valve Retaining (60°) Screw, Valve Retaining (82°) Screw, Valve Retaining (60°) Screw, Valve Retaining (82°)	2 2 -- --	4 4 -- --	6 6 -- --	8 8 -- --	-- -- 12 12	-- -- 16 16	6 6 -- --	12 12 -- --	2656 1349 2656 13491	13490 Present 13490 Present	31964A 1527B 31964A 1527B

NOTES:

* The latest design for cast iron flat top pistons utilizes a set of three compression rings (Part No. 31989M) and can be used in a compressor having cast iron pistons with two compression rings.

#, **, ++, † See note with same symbol on page 21.

+ See note with same symbol on page 23.

A. Abbreviation C.I. = Cast Iron Pistons; Al = Aluminum Pistons.

VILTER MANUFACTURING CORPORATION

440 VMC COMPRESSORS

February 2001
Replaces
February 1985

**PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS
1000 RPM HIGH STAGE AND TWO-STAGE COMPRESSORS
AND 1200 RPM BOOSTER COMPRESSORS**

ITEM	DESCRIPTION NO. OF CYL.	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO-STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
519	Springs, Valve (Volute)	8	16	24	32	--	--	--	--	0+	2198	31915A
519	Springs, Valve (Helical)	8	16	24	32	48	64	24	48	2199+	Present	33803A
520	Yoke, Safety Head	2	4	6	8	--	--	6	12	0	Present	31941B
520	Yoke, Safety Head	--	--	--	--	12	16	--	--	2656	Present	31941B
521	Spring, Safety Head	2	4	6	8	12	16	6	12	0	Present	31882A

NOTES:

- + 1000 RPM high stage and VMC booster compressors with Serial No.'s 2198 and below have volute springs, with the exception of Serial Nos. 2160, 2163, 2168, 2169, 2182, 2183, 2184, 2185, and 2186, which have helical springs. All 1000 RPM high stage and VMC booster compressors with Serial Nos. 2199 and above have helical springs. The old type volute springs are available. However, the safety head for volute springs is not available. If a replacement safety head for volute springs is needed, it will be necessary to purchase the helical spring as well as the safety head for helical springs. When this conversion is made, it is not necessary to make the conversion on all cylinders of the compressors. It may be well to do so to eliminate confusion in the future.

February 2001
Replaces
March 1975

VILTER MANUFACTURING CORPORATION

SECTION 105-R
PAGE 24

440 VMC COMPRESSORS MODERNIZING 1200 RPM COMPRESSORS

Pages 24 through 31 pertain to replacement parts for high speed compressors having serial numbers below 9999. These redesigned replacement parts are incorporated on all high speed compressors having serial numbers 3638 and above. The remaining repair parts pages apply to all existing high speed 440 VMC compressors.

If it is desired to convert an existing high speed 440 VMC compressor having a serial number below 3638 to the latest design arrangement, kits listed below are offered, depending upon the particular compressor involved. It is recommended, though not mandatory, that the old parts be replaced by these kits containing the latest design parts when making a major parts replacement or general overhaul of the compressor.

It is also recommended that all cylinders be converted at one time to avoid unnecessary complications when stocking and ordering future replacement parts. It will not impair the performance of the machine if a combination of converted and unconverted cylinders exist in one machine; however, care must be exercised thereafter in ordering the proper replacement parts for each cylinder.

Purchasing these conversion parts in kit form will result in some savings, as opposed to the purchasing of former style, high speed replacement parts individually. Refer to the Home Office for prices on these conversion kits. Include all information (especially serial number) regarding the compressor to be converted. Also include correct part number for kit as listed below.

KITS ARE AVAILABLE AS FOLLOWS:

COMPRESSOR DESCRIPTION	CYLINDERS WITHOUT UNLOADING		CYLINDERS WITH UNLOADING	
	AMMONIA Part Number	R12, R22 Part Number	AMMONIA Part Number	R12, R22 Part Number
1200 RPM, High Stage with Aluminum Plug Type Pistons	Kits With Connecting Rod Assemblies			
	KT119	KT127	KT123	KT131
1200 RPM High Stage with Cast Iron Plug Type Pistons	*	*	*	*
1200 RPM High Stage with Aluminum Plug Type Pistons	Kits Without Connecting Rod Assembly			
	KT073A	KT075A	KT074A	KT076A
1200 RPM High Stage with Cast Iron Plug Type Pistons	*	*	*	*

* **Kits with Cast Iron Pistons are no longer available. Please contact the home office.**

1. Kits KT119, KT120 * (Ammonia), and Kits KT127, KT128 * (R12, R22), for cylinders without unloading, include the necessary piston rings, Piston and Pin Assembly, Piston Pin Snap Rings, Connecting Rod Assembly, Connecting Rod Bearing Halves, Cylinder Liner, 'O' Ring Seal, Safety Head Assembly, Safety Yoke, Suction Valve Plate, and Helical Valve Springs required to convert one cylinder from a plug type to a flat top piston.
2. Kits KT073A, KT073C * (Ammonia) and Kits KT075A, KT075C * (R12, R22), for cylinders without unloading include all the parts listed in paragraph (1) except the Connecting Rod Assembly and Connecting Rod Bearing Halves.
3. Kits KT123, KT124 * (Ammonia), and Kits KT131, KT132 * (R12, R22) for cylinders with unloading, include all the parts listed in paragraph (1) as well as the Lift Ring and Spring Post Assembly, Lift Springs and Lift Pins.
4. Kits KT074A, KT074C * (Ammonia) and Kits KT076A, KT076C * (R12, R22) for cylinders with unloading include all the parts listed in paragraph (1) and (3) except the Connecting Rod Assembly and Connecting Rod Bearing Halves.

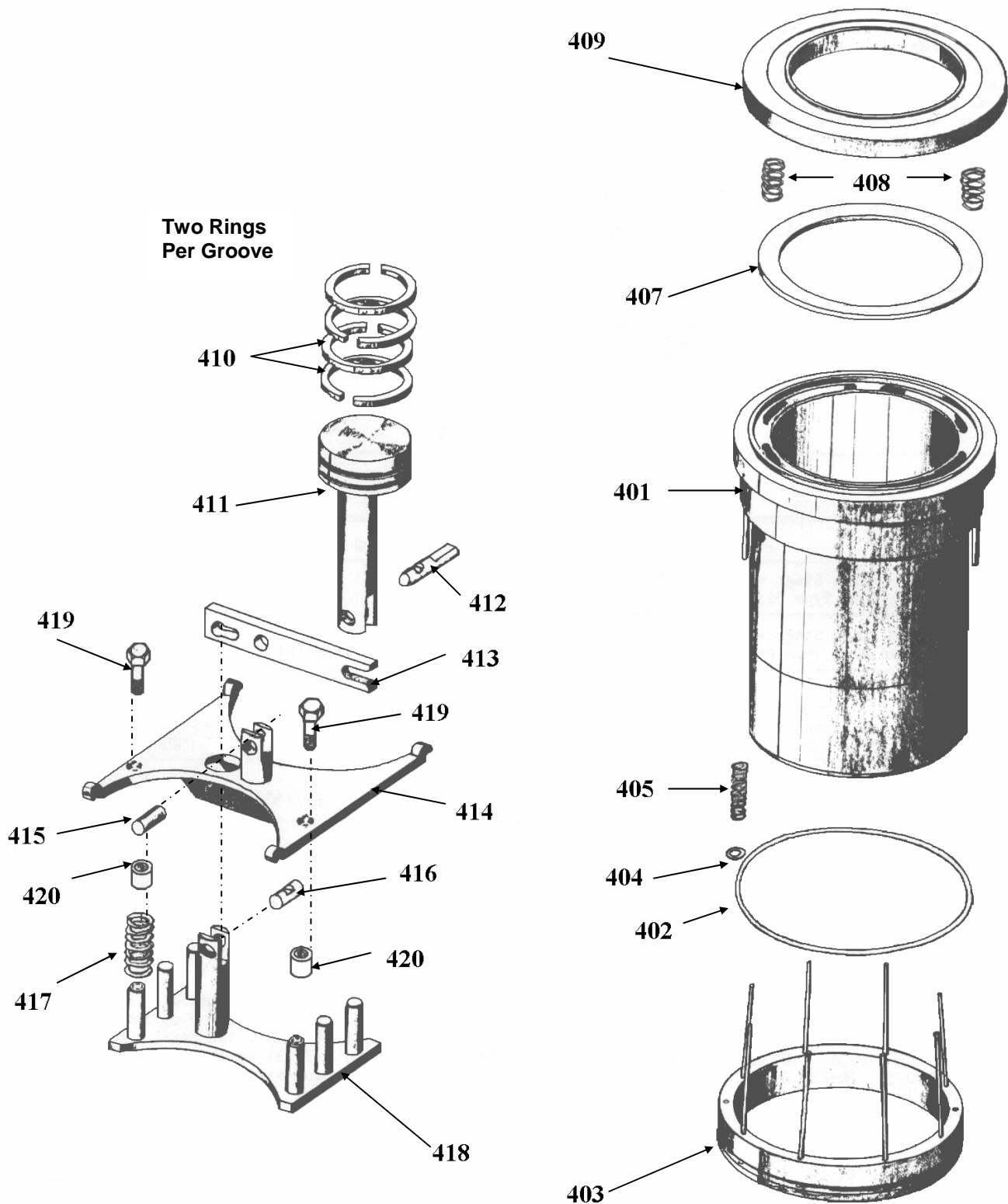
VILTER MANUFACTURING CORPORATION

February 2001
Replaces
March 1975

440 VMC COMPRESSORS

OLD STYLE CYLINDER LINER & CAPACITY CONTROL REPLACEMENT PARTS
FOR 1200 RPM HIGH STAGE COMPRESSORS
WITH **SERIAL NUMBERS BELOW 3638**

FIGURE 11



February 2001
Replaces
August 1974

VILTER MANUFACTURING CORPORATION

SECTION 105-R
PAGE 26

440 VMC COMPRESSORS

CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS 1200 RPM HIGH STAGE COMPRESSORS Serial Numbers 3637 and below

ITEM	DESCRIPTION NO. OF CYL	NO. REQUIRED PER COMPRESSOR						SERIAL NO.		PART NO.
		2	4	6	8	12	16	FROM	THRU	
401 thru 405	Cylinder Liner Kit (For Cylinders w/Unloading)	1*	2	4	4	8	8	0	3637	KT033
401	Cylinder Liner Kit (For Cylinders w/o Unloading)	2	2	2	4	4	8	0	3637	KT032
And 402	(For Cylinders w/o Unloading)	1*	--	--	--	--	--	0	3637	KT032
401	Liner, Cylinder	2	4	6	8	12	16	0	3637	A32609A
402	Seal, 'O' Ring	2	4	6	8	12	16	0	3637	2176BH
403	Unloader Ring Assembly	1*	2	4	4	8	8	0	3637	A33434A
404	Washer, Unloader Spring	2*	4	8	8	16	16	0	3637	33436A
405	Spring, Unloader Ring	2*	4	8	8	16	16	0	3637	33428A
407	Plate, Suction Valve	2	4	6	8	12	16	0	3637	33422A
408	Spring, Valve (Volute)	8	16	24	32	--	--	0+	2049	31915A
408	Spring, Valve (Helical)	8	16	24	32	48	64	2050+	3289	33803A
408	Spring, Valve (Damped Helical)	8	16	24	32	48	64	3290+	3637	13556A††
409	Outer Seat, Ammonia or R12 & R22 Discharge Valve (for Volute Springs)	2	4	6	8	--	--	0+	2049	Obsolete
409	Outer Seat, Ammonia or R12 & R22 Discharge Valve (for Helical Springs)	2	4	6	8	12	16	2050+	3289	Obsolete
409	Outer Seat, Ammonia Discharge Valve (for Damped Helical Springs)	2	4	6	8	12	16	3290+	3637	33587A††
409	Outer Seat, R12 & R22 Discharge Valve (for Damped Helical Springs)	2	4	6	8	12	16	3290+	3637	33586A††
410 thru 412	Piston Kit, Capacity Reduction	1*	1	2	2	4	4	150	3637	KT034
410	Piston Ring, Unloader	4*	4	8	8	16	16	150	3637	35278A
411	Piston	1*	1	2	2	4	4	150	3637	31989L
412	Pin, Long Pivot	1*	1	2	2	4	4	150	3637	33250C
413	Complete Capacity Control Mechanism Assy	1*	--	--	--	--	--	150	3637	A33577A
Thru 420	Complete Capacity Control Mechanism Assy	--	1	2	2	4	4	150	3637	A33354A†
413	Arm, Yoke Lifting	1*	1	2	2	4	4	150	3637	33338A
414	Yoke Assembly	1*	--	--	--	--	--	150	3637	A33575A
414	Yoke Assembly	--	1	2	2	4	4	150	3637	A33335A
415	Pin, $\frac{3}{8}$ " x $1\frac{1}{16}$ " long Roll	1*	1	2	2	4	4	150	3637	1193X
416	Pin, Short Pivot	1*	1	2	2	4	4	150	3637	33250B
417	Spring, Unloader Yoke	6*	6	12	12	24	24	150	3637	33686A
418	Yoke Guide Assembly	1*	--	--	--	--	--	150	3637	A33576A
418	Yoke Guide Assembly	--	1	2	2	4	4	150	3637	A33347A
419	Screw, $\frac{3}{8}$ " x 1" Nylok Cap	2*	--	--	--	--	--	150	3637	1352D
420	Spacer Sleeve	2*	--	--	--	--	--	150	3637	33618A

NOTES:

* These items used on 2 cylinder compressors only when equipped with unloading. For single cylinder unloading, the yoke assembly (Item 414) and two pins on the yoke guide assembly (Item 418) have drilled and tapped holes to accommodate screws (Item 419) and spacers (Item 420).

+ All 1200 RPM VMC Compressors equipped with old style 1200 RPM parts from Serial No. 2050 thru 3289 had helical valve springs. Below 2050 had volute springs except 829, 831, 1489, 1706, 1707, 1723, 1733 and 1735, which also had helical springs. Above 3289 and thru 3637 had damped helical springs. Individual springs of each type are available for replacement; however, discharge valve outer seats to accommodate only the damped helical springs are available obsoleting all other seats. Therefore, when ordering seats for replacement on models previous to 3290, four damped helical valve springs must also be ordered with each seat. Damped springs must then be specified for any subsequent spring replacement. It is not essential that this change be made on all cylinders if made on one. As a means of identification, the regular helical springs are $\frac{7}{16}$ " long and are constructed with two dead coils at the end of the spring that is inserted into the hole. The damped springs are $\frac{17}{32}$ " long and are constructed with a special coil at one end with a closer winding pitch (not completely closed). If desired, see page 24 for converting to new style 1200 RPM parts.

† Refer to Home Office for Compressors with Serial Numbers below 150.

†† Also available in Kit KT035, KT036 or KT037. See page 29.

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
March 1975

440 VMC COMPRESSORS

**CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
1000 RPM HIGH STAGE AND 1200 RPM BOOSTER COMPRESSORS
Serial Numbers 2655 and below**

ITEM	DESCRIPTION NO. OF CYL	NO. REQUIRED PER COMPRESSOR						SERIAL NO.		PART NO.
		2	4	6	8	12	16	FROM	THRU	
401 Thru 402A	Cylinder Liner Kit (w/o unloading)	--	--	--	--	4	8	0	2655	KT032
403	Unloader Ring Assembly	--	--	--	--	8	8	0	2655	A33434A
404	Washers, Unloader Spring	--	--	--	--	16	16	0	2655	33436A
409	Outer Seat, Ammonia Discharge Valve	--	--	--	--	12	16	0	2655	33587A
409	Outer Seat, R12 & R22 Discharge Valve	--	--	--	--	12	16	0	2655	33586A

NOTE:

These parts are given for information purposes only – parts are no longer available.

February 2001
Replaces
August 1974

VILTER MANUFACTURING CORPORATION

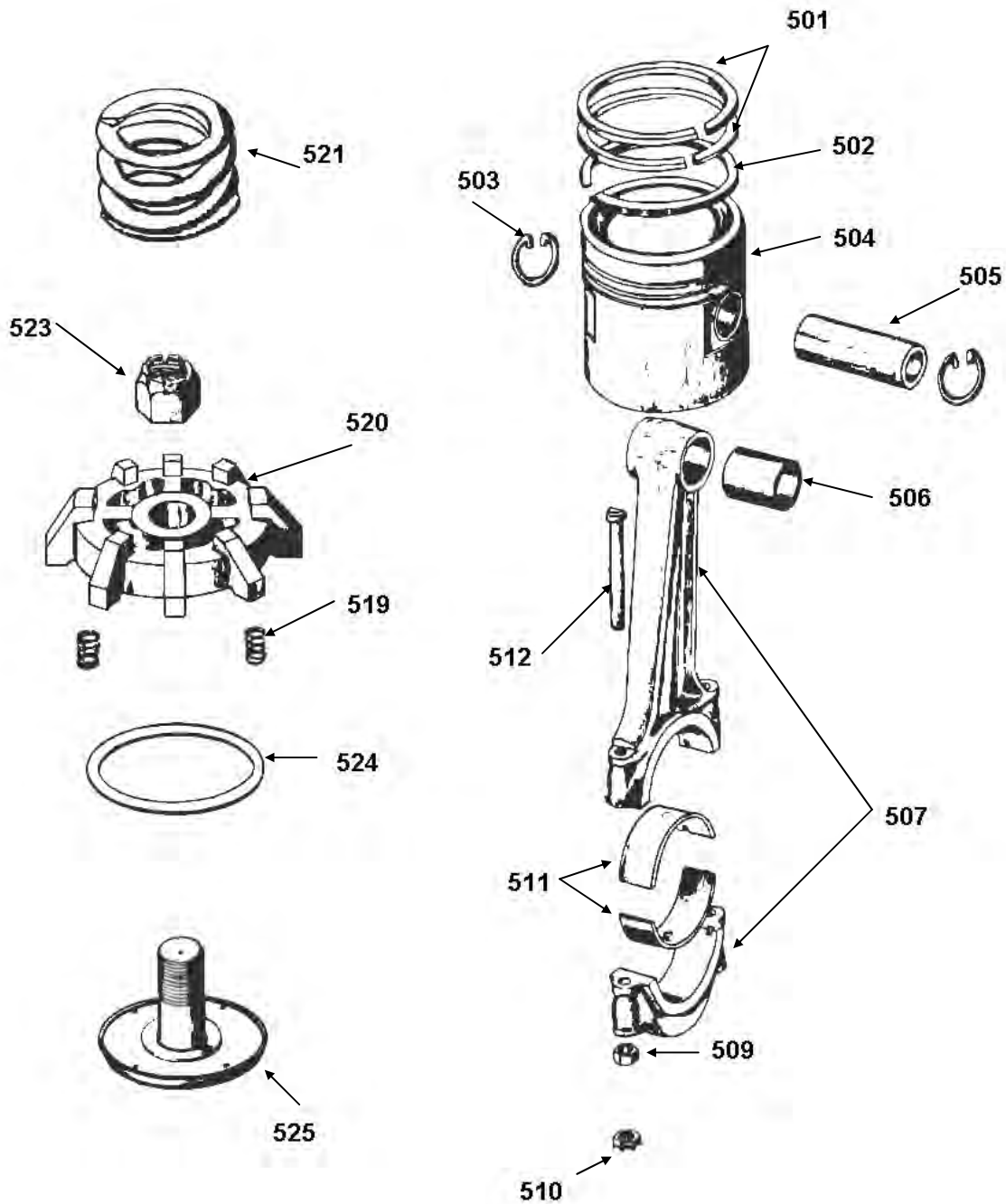
SECTION 105-R
PAGE 28

440 VMC COMPRESSORS

OLD STYLE PISTON AND CONNECTING ROD REPLACEMENT PARTS 1200 RPM COMPRESSORS

SERIAL NUMBERS BELOW 3638

FIGURE 12



VILTER MANUFACTURING CORPORATION

February 2001
Replaces
March 1984

440 VMC COMPRESSORS
PISTON AND CONNECTING ROD REPLACEMENT PARTS
FOR 1200 RPM HIGH STAGE
Serial Numbers Below 3638

ITEM	DESCRIPTION	NO. OF CYL	NO. REQUIRED PER COMPRESSOR						SERIAL NO.		PART NO.
			2	4	6	8	12	16	FROM	THRU	
501 thru 512	Piston (Cup, CI) and Conn. Rod Assy Kit		2	4	6	8	--	--	0*	1659	KT116
	Piston (Cup, AL) and Conn. Rod Assy Kit		2	4	6	8	12	16	1660*	3637	KT117
501	Piston Ring, Compression		4	8	12	16	24	32	0	3637	31989M
502	Piston Ring, Oil		2	4	6	8	12	16	0	3637	31989N
503	Snap Ring, Piston Pin		4	8	12	16	24	32	0	3637	33244A
504 and 505	Piston (Cup, CI) and Piston Pin Assy		2	4	6	8	--	--	0*	1659	A32457A
	Piston (Cup, AL) and Piston Pin Assy		2	4	6	8	12	16	1660*	3637	A32567A
506,507, 510,511 & 512	Connecting Rod Assembly with Bearing Kit		2	4	6	8	12	16	0	3637	KT212
506	Bushing, Piston Pin		2	4	6	8	12	16	0	3637	31896B #
507	Connecting Rod and Cap		2	4	6	8	12	16	0	3637	Order Kit
509	Nut, Plain, Hex $\frac{3}{8}$ "-24UNF		4	8	12	16	24	32	0	3637	2027A
510	Nut Lock, $\frac{3}{8}$ "-24NF		4	8	12	16	24	32	0	3637	2028A
511	Bearing Half, Connecting Rod		4	8	12	16	24	32	0	3637	KT512 ++
511	Bearing Half, Connecting Rod - .030" Undersize		4	8	12	16	24	32	0	3637	KT513 ++
512	Bolt, Connecting Rod		4	8	12	16	24	32	0	3637	31955A
519 Thru 525 Except 521	Safety Yoke and Discharge Valve Inner Seat Assembly - (for Volute Springs) (for Helical Springs) (for Damped Helical Springs, Amm&R22) (for Damped Helical Springs, R12)		2	4	6	8	--	--	0+	2049	Obsolete
			2	4	6	8	12	16	2050+	3289	Obsolete
			2	4	6	8	12	16	3290+	3637	A33588A
			2	4	6	8	12	16	3290+	3637	A33588B
519 thru 525 Except 521 Plus 408 & 409	Complete Safety Yoke Assy Kit (Amm)		2	4	6	8	12	16	0	3637	KT035
	Complete Safety Yoke Assy Kit (R12)		2	4	6	8	12	16	0	3637	KT036
	Complete Safety Yoke Assy Kit (R22)		2	4	6	8	12	16	0	3637	KT037
519	Springs, Valve (Volute)		16	32	48	64	--	--	0+	2049	31915A
519	Springs, Valve (Helical)		16	32	48	64	96	128	2050+	3289	33803A
519	Springs, Valve (Damped Helical)		16	32	48	64	96	128	3290+	3637	13556A
520	Safety Yoke and Pin Assembly - (for Volute Springs) (for Helical Springs) (for Damped Helical Springs)		2	4	6	8	--	--	0+	2049	Obsolete
			2	4	6	8	12	16	2050+	3289	Obsolete
			2	4	6	8	12	16	3290+	3637	A33585A
521	Spring, Safety Head		2	4	6	8	12	16	0	3637	31882A
523	Nut, 1" Flexloc		2	4	6	8	12	16	0	3637	1330B
524	Plate, Discharge Valve - Ammonia, R22		4	8	12	16	24	32	0	3637	33423A
524	Plate, Discharge Valve - R12		2	4	6	8	12	16	0	3637	33423A
525	Inner Seat, Discharge Valve		2	4	6	8	12	16	0	3637	33421A

NOTES:

Designation: C.I. = Cast Iron Pistons; AL. = Aluminum Pistons.

* All 1200 RPM VMC Compressors with Serial No. 1660 and above have aluminum pistons except 1875, 1876 and 1880, which have cast iron pistons. All other 1200 RPM VMC's have cast iron pistons with the exception of Serial No. 1489, which has the aluminum pistons. See note on Page 10 for crankshaft requirements.

+ All 1200 RPM VMC Compressors equipped with old style 1200 RPM parts from Serial No. 2050 thru 3289 had helical valve springs. Below 2050 had volute springs except 829, 831, 1489, 1706, 1707, 1723, 1733 and 1735, which also had helical springs. Above 3289 and thru 3637 had damped helical springs. Individual springs of each type are available for replacement; however, safety yoke and pin assemblies and safety yoke and discharge valve inner seat assemblies to accommodate only the damped helical springs are available, obsoleting all previous comparable assemblies. Therefore, when ordering these assemblies for replacement on models previous to 3290, eight damped helical valve springs must also be ordered with each assembly. Damped springs must then be specified for any subsequent spring replacement. It is not essential that this change be made on all cylinders if made on one. As a means of identification, the regular helical springs are $\frac{7}{16}$ " long and constructed with two dead coils at the end of the spring that is inserted into the hole. The damped springs are $\frac{17}{32}$ " long and are constructed with a special coil at one end with a closer winding pitch (not completely closed). If desired, see page 24 for converting to new style 1200 RPM parts.

#, ++ See note with same symbol on page 21.

February 2001
Replaces
February 1985

VILTER MANUFACTURING CORPORATION

SECTION 105-R
PAGE 30

440 VMC COMPRESSORS

PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS 1000 RPM HIGH STAGE AND 1200 RPM BOOSTER COMPRESSORS Serial Numbers 3067 and below

ITEM	DESCRIPTION NO. OF CYL	NO. REQUIRED PER COMPRESSOR						SERIAL NO.		PART NO.
		2	4	6	8	12	16	FROM	THRU	
501 Thru 505	Piston (Flat, CI) Rings & Pin Kit	2	4	6	8	--	--	0	3067	KT214
501 Thru 512	Piston (Flat, CI) & Conn Rod Assy Kit Piston (Cup, AL) & Conn Rod Assy Kit	2 --	4 --	6 --	8 --	-- 12	-- 16	0 0	3067 2655	KT114 KT117
504 & 505	Piston (Cup, AL) & Pin Assy	--	--	--	--	12	16	0	2655	A32567A
519 Thru 525 Except 521	Safety Yoke & Discharge Valve Inner Seat Assy – Amm & R22 Safety Yoke & Discharge Valve Inner Seat Assy – R12	-- --	-- --	-- --	-- --	12 12	16 16	0 0	2655 2655	A33588A A33588B
520	Assembly, Safety Yoke & Pin	--	--	--	--	12	16	0	2655	A33585A
523	Nut, 1" Flexloc	--	--	--	--	12	16	0	2655	1330B
524	Plate, Discharge Valve – Amm & R22	--	--	--	--	24	32	0	2655	33423A
524	Plate, Discharge Valve – R12	--	--	--	--	12	16	0	2655	33423A
525	Inner Seat, Discharge Valve	--	--	--	--	12	16	0	2655	33421A

VILTER MANUFACTURING CORPORATION

February 2001
Replaces
April 1984

440 VMC COMPRESSORS

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
Serial Numbers 9999 and below

ITEM	DESCRIPTION NO. OF CYL.	NO. REQ. PER COMPRESSOR								SERIAL NO.		PART NUMBER
		SINGLE STAGE						TWO- STAGE		FROM	THRU	
		2	4	6	8	12	16	6	12			
220	Shim, Rear Bearing Retainer	1	1	1	1	--	--	1	--	0	1659	A31905A
224 Thru 233	Complete Crankshaft Assy (1200 RPM) For Cast Iron Pistons For Cast Iron Pistons	-- --	-- --	1 --	-- 1	-- --	-- --	-- --	-- --	0 0	1659 1659	A32612C A32612D
224 Thru 233	Complete Crankshaft Assy (1000 RPM) For Cast Iron Pistons For Cast Iron Pistons	-- --	-- --	1 --	-- 1	-- --	-- --	-- --	-- --	0 0	3067 3067	A32612C A32612D
225 225 226	Lockwasher, Crankshaft Bearing Lockwasher, Crankshaft Bearing Lock, Bearing	1 -- 1	1 -- 1	1 -- 1	1 -- 1	-- 1 --	-- 1 --	1 -- 1	-- 1 --	0 0 0	9999 9999 1659	33365A + 35502A + 31902A
229 †	Crankshaft (1200 RPM) (w/oilways plug) For Cast Iron Pistons (*) For Cast Iron Pistons (*)	-- --	-- --	1 --	-- 1	-- --	-- --	-- --	-- --	0 0	1659 1659	A30291A A30304A
229 †	Crankshaft (1000 RPM) (w/oilways plug) For Cast Iron Pistons (*) For Cast Iron Pistons (*)	-- --	-- --	1 --	-- 1	-- --	-- --	-- --	-- --	0 0	3067 3067	A30291A A30304A

NOTES:

- * Some compressors using cast iron pistons were equipped with an obsolete oil pump drive. If the compressor is not equipped with Item 233, and an interchangeable replacement crankshaft is ordered, it is necessary to order Item 233 at extra cost.
- + When ordering a crankshaft bearing locknut (Item 224) for a compressor with Serial No. 9999 and below, also order crankshaft bearing lockwasher (Item 225).
- † When ordering bare crankshaft for a compressor with Serial No. 9999 and below, also order Item 224, crankshaft bearing locknut and retaining compound kit.
- *** Crankshafts for Cast Iron Piston for these machines are no longer available. Use current crankshaft and convert the compressor to aluminum pistons.

February 2001
Replaces
March 1984

VILTER MANUFACTURING CORPORATION

SECTION 105-R
PAGE 32

440 VMC COMPRESSORS

HEAVY-DUTY (+) V-BELT DRIVEN REPLACEMENT PARTS

"Heavy-Duty" 8-cylinder 440 VMC Compressors are also available for use with V-Belt drives up to a maximum of 125 BHP as compared to the maximum of 100 BHP for the standard, 8-cylinder 440 VMC Compressors. This compressor will supplement, not replace, the standard 8-cylinder 440 VMC Compressor. This higher BHP is possible due to modifications of design. Construction of the "Heavy-Duty" compressor will be the same as the standard 8-cylinder 440 VMC Compressor except that a 12 or 16-cylinder front bearing cover assembly and rotary shaft seal replace the standard 8-cylinder parts. The crankshaft (†) is of special stepped design with a 3" diameter on the drive end and a 2½" diameter on the pump end. The standard 8-cylinder 440 VMC Compressor has a straight shaft of 2½" diameter.

REPAIR PARTS FOR 8-CYLINDER 1000 AND 1200 RPM HEAVY-DUTY 440 VMC COMPRESSORS
CAN BE SELECTED FROM THE PRECEDING REPAIR PARTS PAGES
FOR THE LATEST DESIGN OF STANDARD 8-CYLINDER COMPRESSOR
WITH THE **EXCEPTION** OF THE FOLLOWING:

ITEM NUMBER	DESCRIPTION	NUMBER REQUIRED	PART NUMBER
201 thru 211A	Front Bearing Cover and Relief Assembly	1	A32566A
209 thru 211A	Front Bearing Cover Assembly	1	A36241A
211	Cover, Front Bearing	1	*
214	Retainer, Front Bearing	1	33500A
217	Rotary Shaft Seal Assembly	1	A33489A
218	Gasket, Shaft Seal Cover	1	33496A
220	Cover, Shaft Seal	1	32564A
224 thru 233 †	Complete Crankshaft Assembly (for Aluminum Pistons)	1	A32792B
224 **	Locknut and Retaining Compound Kit	1	KT367
227 **	Front Bearing and Retaining Compound Kit	1	KT369
228	Ring, Front Bearing Retaining	1	33145A
229 **†	Crankshaft and Retaining Compound Kit (for Aluminum Pistons)	1	KT374
229 †	Crankshaft (for Cast Iron Pistons)	1	A32255A
501 thru 505	Piston (Flat, Cast Iron), Rings and Pin Assembly Kit	8	KT214
501 thru 505	Piston (Flat, Aluminum), Rings and Pin Assembly Kit	8	KT213
501	Piston Ring, Compression	24	31989M
502	Piston Ring, Oil	8	31989N
501 thru 512	Piston (Cast Iron) Assembly and Connecting Rod Kit	8	KT114
501 thru 512	Piston (Aluminum) Assembly and Connecting Rod Kit	8	KT478

NOTES:

- * Sold only in front bearing cover assembly.
- ** Includes retaining compound for bearing lock nut. Retaining compound also available separately, order part number KT365.
- † Shot peening is not standard on "Heavy-Duty" crankshafts, but is available as an option.
- + Heavy-Duty compressors are identified by "HD" in the serial number.

VILTER MANUFACTURING CORPORATION

February 2001

Replaces

February 1984

440 VMC COMPRESSORS
RECOMMENDED SPARE PARTS LIST

ITEM	PART NAME	PART NUMBER	QUANTITY PER COMPRESSOR RECOMMENDED FOR STOCK							
			SINGLE STAGE						TWO STAGE	
			2	4	6	8	12	16	6	12
--	Gasket Kit, Complete	KT041	1	--	--	--	--	--	--	--
--	Gasket Kit, Complete	KT043	--	1	--	--	--	--	--	--
--	Gasket Kit, Complete	KT045	--	--	1	--	--	--	--	--
--	Gasket Kit, Complete	KT049	--	--	--	1	--	--	--	--
--	Gasket Kit, Complete	KT051	--	--	--	--	1	--	--	--
--	Gasket Kit, Complete	KT055	--	--	--	--	--	1	--	--
--	Gasket Kit, Complete	KT056	--	--	--	--	--	--	1	--
--	Gasket Kit, Complete	KT089	--	--	--	--	--	--	--	1
118	Safety Valve (Internal Relief)	1721B	1	1	1	1	2	2	--	--
217	Rotary Shaft Seal Assembly	A33483A	1	1	1	1	--	--	1	--
217	Rotary Shaft Seal Assembly	A33489A	--	--	--	--	1	1	--	1
306	Oil Pump Assembly (for all 440 VMC Compressor)	A33480A	1	1	1	1	1	1	1	1
315	Recharge (Includes Gasket 1448B) (Standard Tri-Micro Filter)	1448C	1	1	1	1	1	1	1	1
315	Recharge (Includes Gasket 1448B) (Special-Improved Tri-Micro Filter Option)	2115C	1	1	1	1	1	1	1	1
321	Gasket, Oil Filter Head	1448B	1	1	1	1	1	1	1	1
401 Thru 402A	Cylinder Liner Kit (for Cylinder w/o Unloading) a. 1000 RPM Compressors b. 1200 RPM Compressors Serial No. 3638 to present	KT071 KT071	1 1	1 1	2 2	2 2	2 2	2 2	2 2	2 2
401 Thru 406	Cylinder Liner Kit (for Cylinder w/Unloading) a. 1000 RPM Compressors b. 1200 RPM Compressors Serial No. 0 to 3637 c. 1200 RPM Compressors Serial No. 3638 to Present	KT072 KT033 KT072	1 1 1	1 1 1	2 2 2	2 2 2	2 2 2	2 2 2	2 -- 2	2 -- 2
405	Spring, Lift – 1000 RPM (1200 RPM, 3638 to Present) and All Boosters	33352A	4	4	8	8	8	8	8	8
405	Spring, Lift – 1200 RPM below Serial No. 3638	33428A	2	2	4	4	4	4	--	--
407	Suction Valve Plate – 1000 RPM (1200 RPM, 3638 to Present) and All Boosters	31909A	1	1	2	2	2	2	2	2
407	Suction Valve Plate – 1200 RPM, below Serial No. 3638	33422A	1	1	2	2	2	2	--	--
413 Thru 420	Capacity Control Assembly a. Two Cylinder and Two-Stage Compressors b. All Other Compressors	A33577A A33354A	1 --	-- 1	-- 1	-- 1	-- 2	-- 2	1 --	2 --
501 Thru 512	Piston and Connecting Rod Assembly Kit a. Cast Iron, Flat Top Piston (1000 RPM) b. Aluminum, Flat Top Piston (All Speeds)	KT114 KT478	1 1	1 1	2 2	2 2	2 2	2 2	-- 2	-- 2
501	Piston Ring, Compression	31989M	6	12	12	12	18	24	12	18
502	Piston Ring, Oil	31989N	1	1	2	2	2	2	2	2
509	Nut, Plain, Hex $\frac{3}{8}$ "-24UNF	2027A	4	8	12	16	24	32	12	24
510	Nut, Lock, $\frac{3}{8}$ "-NF	2028A	4	8	12	16	24	32	12	24
511	Bearing Half, Connecting Rod	KT512	2	4	6	8	12	16	6	12
512	Bolt, Connecting Rod	31955A	4	8	12	16	24	32	12	24
513 Thru 518	Safety Head Assy, Ammonia (All Speeds) Safety Head Assy, Halocarbon (All Speeds)	A32695C A32695D	1 1	1 1	2 2	2 2	3 3	3 3	2 2	3 3
515	Diaphragm Discharge Valve Plate (all speeds)	31939B	6	12	18	24	36	48	18	36
518	Valve Retaining Screw	1527B	2	4	6	8	12	16	6	12
519	Valve Springs (Volute)	31915A	8	16	24	32	--	--	--	--
519	Valve Springs (Helical)	33803A	8	16	24	32	48	64	24	32
519	Valve Springs (Damped Helical – 1200 RPM)	13556A	8	16	24	32	48	64	--	--
524	Discharge Valve Plate, 1200 RPM Compressor - Serial No. 0 to 3637	33423A	2	2	4	4	4	4	--	--

NOTES:

- A. The above listing includes the minimum selection and quantity of recommended spare parts. It may vary considerably depending upon the circumstances. All items listed do not necessarily apply to every compressor, because of serial number application or optional features. Items that apply should be selected for each individual compressor.
- B. All of the above parts can be used with either ammonia, R12 or R22 compressors unless specified otherwise.

**460 VMC COMPRESSORS
REPLACEMENT PARTS LIST**

TABLE OF CONTENTS

<u>PAGE</u>	
1	REPLACEMENT PARTS ORDERING INSTRUCTIONS
	BASIC FRAME REPLACEMENT PARTS
2	Illustration, 2 Cylinder (Figure 1)
3	Illustration, 4, 6 & 8 Cylinder (Figure 2)
4	Parts List
	CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
6	Illustration (Figure 3)
7	Parts List
	REAR BEARING COVER REPLACEMENT PARTS
8	Illustration (Figure 4)
9	Parts List
	CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
10	Illustration (Figure 5)
11	Parts List
	PISTON AND CONNECTING ROD ASSEMBLY AND SAFETY HEAD REPLACEMENT PARTS
12	Illustration (Figure 6)
13	Parts List

REPLACEMENT PARTS ORDERING INSTRUCTIONS

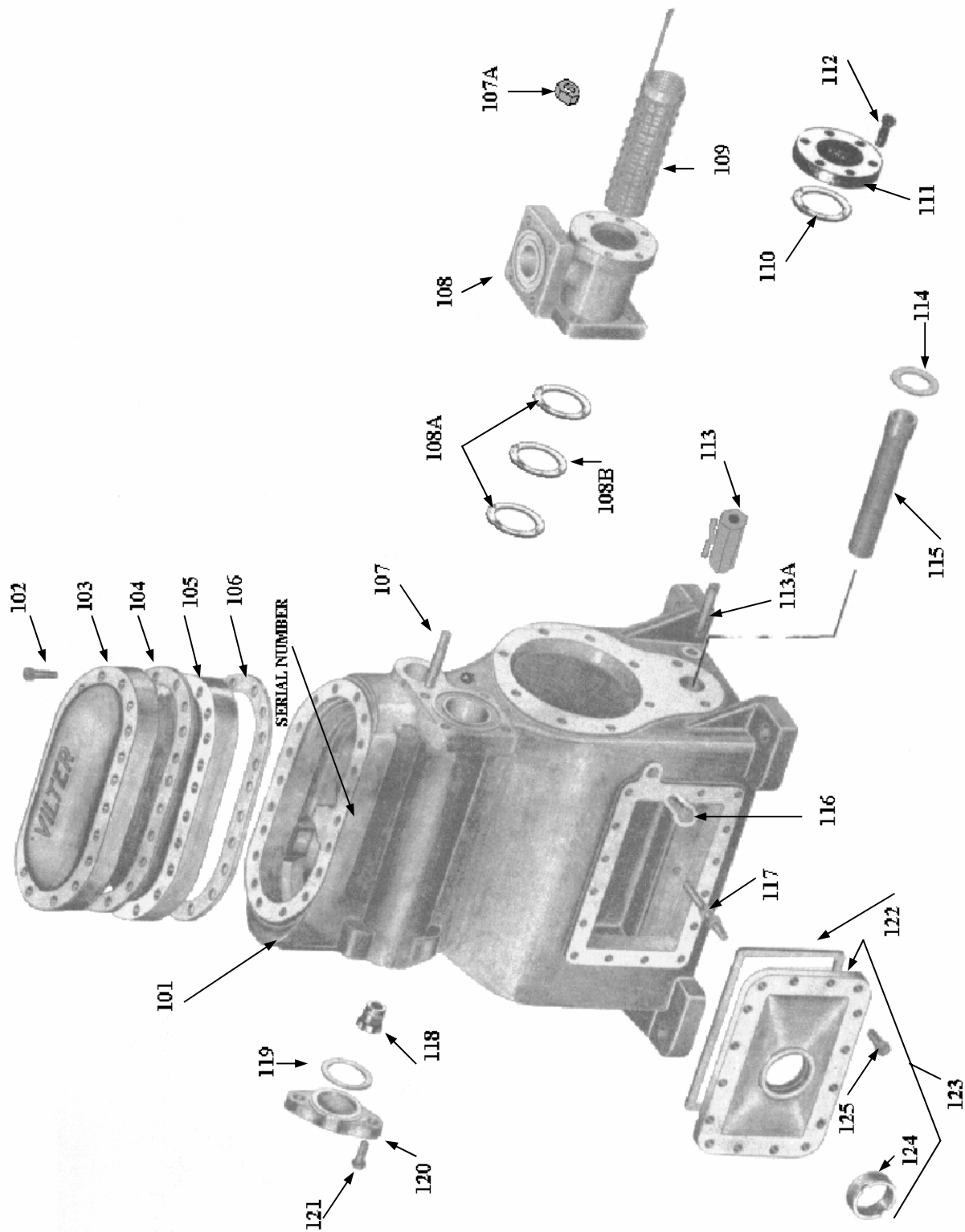
1. Give the size, voltage, original order number and serial number of the compressor. All of this information is stamped on the nameplate attached to the compressor frame. The serial number is also stamped on the compressor frame. The compressor frame serial number location is directly above the suction flange on the frame of the compressor or directly above the rear bearing cover. The rear bearing is located on the oil pump/filter end of the compressor.
2. Always give the name of the part as well as the corresponding part number and/or item number. Also include the quantity of parts required.
3. Should there be a doubt regarding the part number or name, send a sketch of the part required or return the old part as a sample, transportation charges prepaid. Orders on which part numbers and description do not agree will be filled according to our best interpretation.
4. All prices are F.O.B. factory. Minimum domestic parts order is \$75.00 net price.
5. Please indicate on the order preferred method of shipment. We will follow your instructions unless it is to your best interest to change routing.
6. If you purchased the compressor from a party other than Vilter Manufacturing Corporation, please state when you purchased the compressor and from whom.

VILTER MANUFACTURING CORPORATION

February 2001
Original Issue

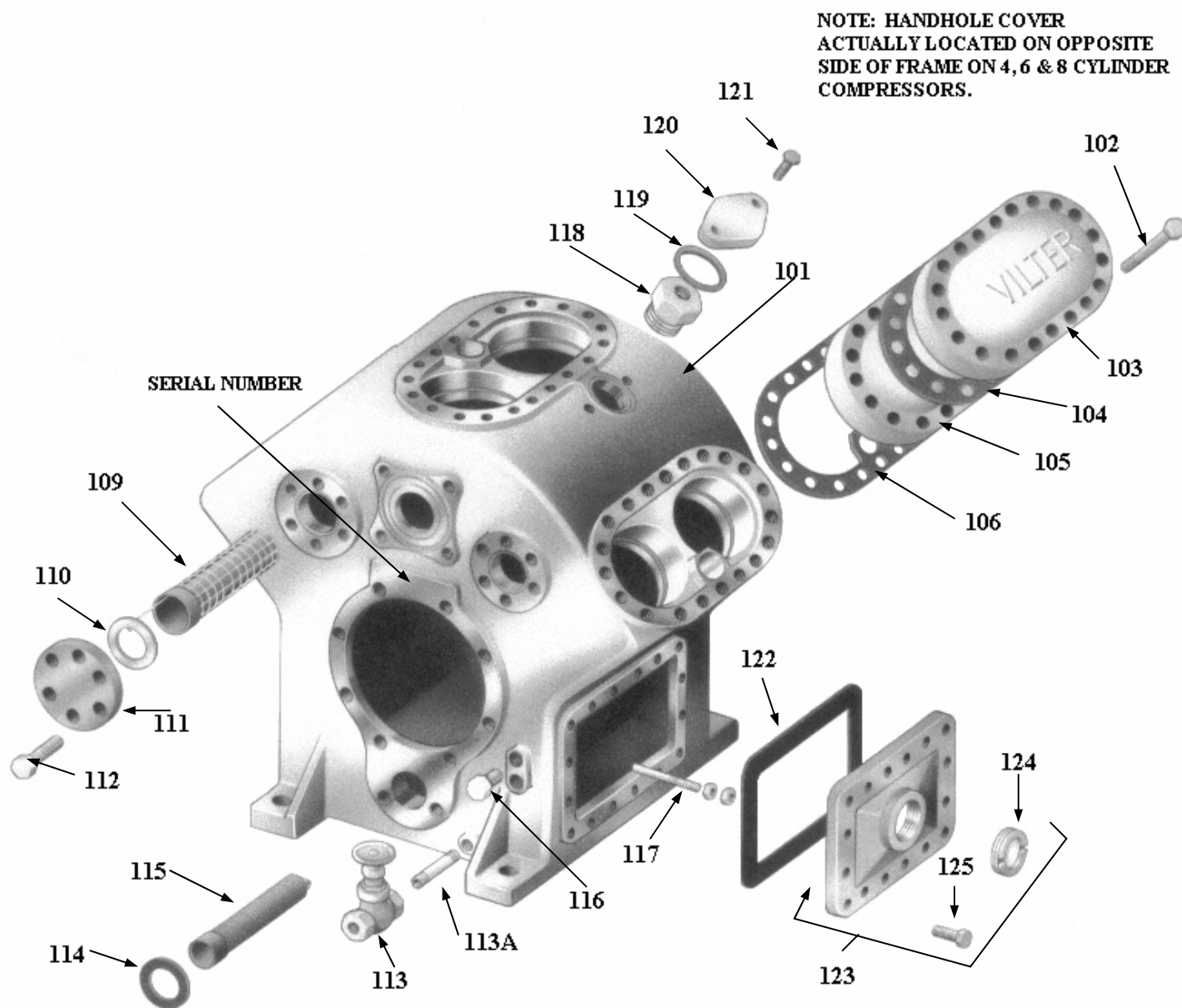
460 VMC COMPRESSORS

2 CYLINDER BASIC FRAME REPLACEMENT PARTS
FIGURE 1



460 VMC COMPRESSORS

4, 6 AND 8 CYLINDER BASIC FRAME REPLACEMENT PARTS
FIGURE 2



460 VMC COMPRESSORS

BASIC FRAME REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS				PART NUMBER
		2	4	6	8	
101	Frame	1	1	1	1	*
102	Screw, $\frac{5}{8}$ " x 2 $\frac{1}{2}$ " Hex. Head Cap (Used w/o Water Jacket)	20	40	60	80	13152G
102	Screw, $\frac{5}{8}$ " x 3 $\frac{1}{2}$ " Hex. Head Cap (Used with Water Jacket)	20	40	60	80	13152L
103	Cover, Water Jacket	1	2	3	4	30299A
104	Gasket, Water Jacket	1	2	3	4	33329A
105	Cover, Cylinder					
	w/o Capacity Reduction	--	1	--	2	A30332A
	w/Capacity Reduction	--	1	--	2	30332B
	w/Capacity Reduction	1	--	1	--	A30364A
	Banks w/o Capacity Reduction	1	--	1	--	A30364A
	w/Capacity Reduction	1	--	1	--	30364B
106	Gasket, Cylinder Cover	1	2	3	4	33330A
107	Stud, $\frac{5}{8}$ " x 3" (shown only on 2 cylinder)	8	4	4	4	13156D
107	Stud, $\frac{3}{4}$ " x 3 $\frac{1}{4}$ " (not shown)	--	4	4	4	13157D
107A	Nut, $\frac{5}{8}$ -11NC-2B					1726G
107A	Nut, $\frac{3}{4}$ -10NC-2B	--	4	4	4	1726H
108	Tee, Suction (++)					
	2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ "	1	--	--	--	A30319A
	3 $\frac{1}{2}$ " x 3"	--	1	--	--	A32417B
	Elbow, Discharge (++)					
	2" x 2" (Ammonia)	1	--	--	--	12270E
	2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " (Ammonia)	--	1	--	--	12270F
	3" x 3" (Ammonia)	--	--	1	--	12271E
	4" x 3" (Ammonia)	--	--	--	1	A32498A
109	Suction Screen	1	--	2	2	A32428B
109	Suction Screen	--	1	--	--	A32428A
109	Suction Screen (Center)	--	--	--	1	A32428C
109	Suction Screen (R.H. Side, 8 cyl., 75% Cap. Red.)	--	--	--	1	A32428D
109-A	Bag, Suction Screen (not shown)	--	1	--	--	A33474A
109-A	Bag, Suction Screen (not shown)	1	--	2	3	A33474B
109-A	Bag, Suction Screen (not shown)	--	--	1	1	A35234A
110	Gasket, Suction Screen Cover	1	--	2	2	31892A
110	Gasket, Suction Screen Cover	--	1	--	--	11323J
110	Gasket, Suction Cover	--	--	1	1	35217A
111	Cover, Suction Screen	1	--	2	2	31893A
111	Cover, Suction Screen	--	1	--	1	13706A
111	Cover, Suction Screen	--	--	1	1	35216A
112	Screw, $\frac{5}{8}$ " x 1 $\frac{1}{2}$ " Hex. Head Cap	--	5	--	5	13152E
112	Screw, $\frac{5}{8}$ " x 1 $\frac{3}{4}$ " Hex. Head Cap	6	--	12	12	13153E
113	Valve, $\frac{1}{2}$ " Oil Charge and Drain (Ammonia)	1	1	1	1	A15375A
113	Valve, $\frac{1}{2}$ " Oil Charge and Drain (Halocarbon)	1	1	1	1	1956A
113A	Nipple, $\frac{1}{2}$ " x 4" Sch. 80 Pipe	1	1	1	1	13189G
114	Gasket, Crankcase Oil Screen	1	1	1	1	31889A
115	Crankcase Oil Screen Assembly	1	1	1	1	A31886A
116	Plug, $\frac{1}{2}$ " Hex. Head Pipe	1	1	1	1	13264D
116	Plug, $\frac{3}{4}$ " Hex. Head Pipe	1	1	1	1	13264E
117	Pin Retaining Assembly for Compressor Oil Screen	1	1	1	1	A31936A
118	Safety Valve, Internal Relief	1	1	1	1	1721B
119	Gasket, 2" Flange	1	1	1	1	11323G
120	Cover, Safety Valve	1	1	1	1	31954A
121	Screw, $\frac{5}{8}$ " x 2" Hex. Head Cap	2	2	2	2	13152E
122	Gasket, Handhole Cover	1	1	1	1	31894A

NOTES:

* Part Number on application.

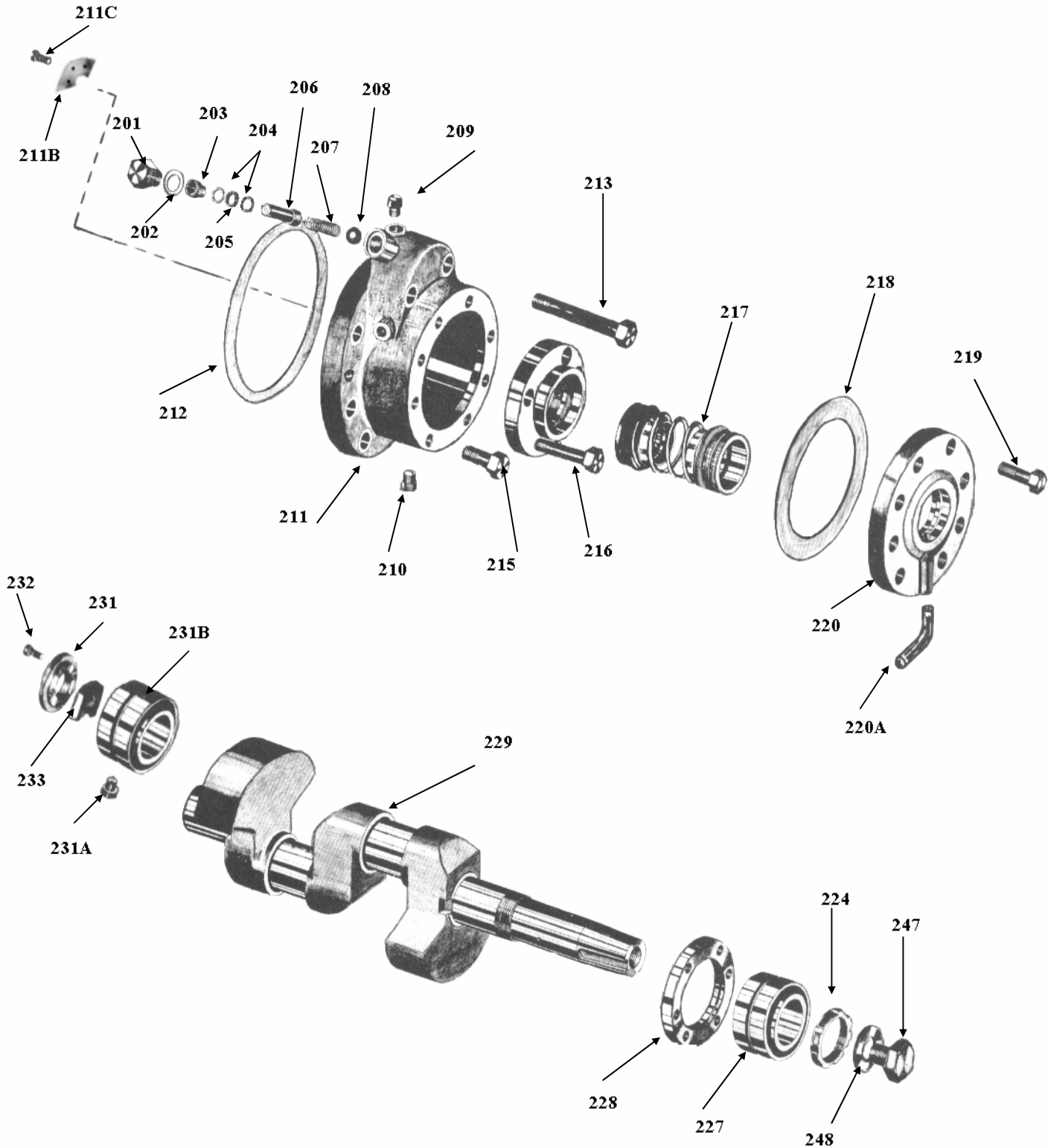
460 VMC COMPRESSORS

BASIC FRAME REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS				PART NUMBER
		2	4	6	8	
123 & 124	Handhole Cover and 2" Sight Glass Assy With openings for:					
	560W NEMA 1 & 7 Htr., F.V. & Therm.	1	1	1	1	A33034G
	300W NEMA 1 & 7 Heater and Therm.	1	1	1	1	A33034GA
	560W NEMA 1 & 7 Htr. & Therm.	1	1	1	1	A33034L
	300W NEMA 1 & 7 Htr. & Therm.	1	1	1	1	A33034LA
123A	Cover, Handhole (without openings) (not shown)	--	--	--	--	33034B
124	Glass, Oil Sight – 2"	1	1	1	1	1484A
125	Screw, ½" x 1½" Hex Head Cap	16	16	16	16	2796E

460 VMC COMPRESSORS

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS
FIGURE 3



VILTER MANUFACTURING CORPORATION

February 2001
Original Issue

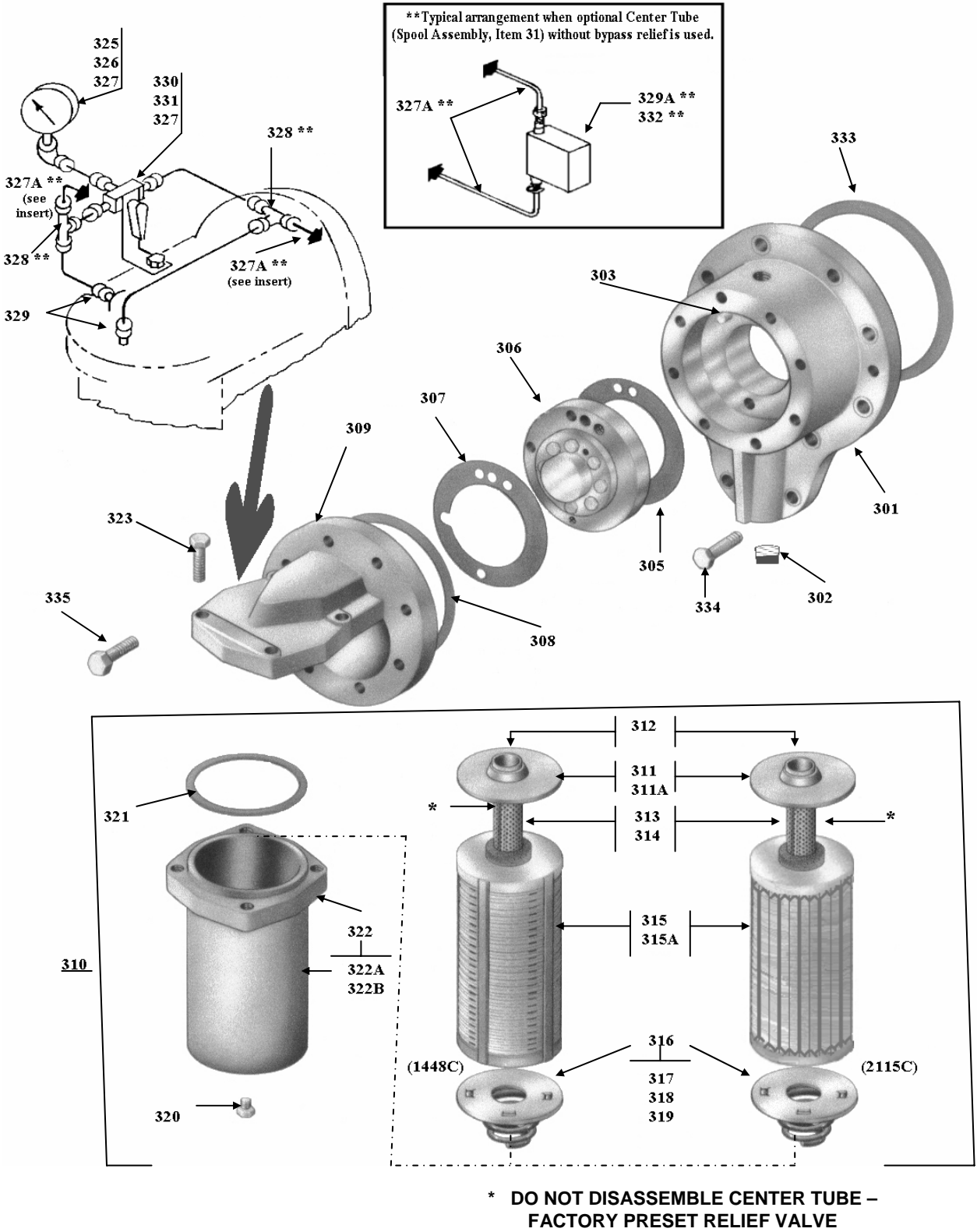
460 VMC COMPRESSORS

CRANKSHAFT AND FRONT BEARING COVER REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS				PART NUMBER
		2	4	6	8	
201 thru 211	Front Bearing Cover and Relief Valve Assy	1	1	1	1	A32566A
201	Cap, Valve	1	1	1	1	17355A
202 thru 208	Oil Relief Valve Kit	1	1	1	1	KT486
202	Gasket, Valve Cap	1	1	1	1	30651C
203	Nut, Packing	1	1	1	1	31048A
204	Washer	2	2	2	2	31048D
205	Packing, $\frac{7}{8}$ " O.D. x $\frac{39}{64}$ " I.D. x $\frac{3}{8}$ "	1	1	1	1	31048E
206	Stem, Valve	1	1	1	1	31048C
207	Spring	1	1	1	1	31048F
208	Ball, $\frac{5}{8}$ " dia. Steel	1	1	1	1	13155K
209 thru 211	Front Bearing Cover Assembly for 2 $\frac{1}{2}$ " Shaft (Requires Oil Orifice in Item 214)	1	1	1	1	A36240A
209 thru 211	Front Bearing Cover Assembly for 3" Shaft (Requires Oil Orifice in Item 214)	1	1	1	1	A36241A
209	Plug, $\frac{1}{4}$ " Hex Head Pipe	1	1	1	1	13264B
210	Plug, $\frac{3}{8}$ " Hex Head Pipe	1	1	1	1	13264C
211	Cover, Front Bearing	1	1	1	1	Order Assy
211B	Shield, Splash	1	1	1	1	35274A
211C	Screw, Hexagon Hd. No. 10-32 x $\frac{3}{8}$ " long	3	3	3	3	2583A
212	Gasket, Bearing Cover	1	1	1	1	31890A
213	Screw, $\frac{5}{8}$ " x 4" Hex Socket Head Cap	2	2	2	2	13159E
214	Retainer, Front Bearing (with Oil Hole)	1	1	1	1	31885A
215	Screw, $\frac{5}{8}$ " x 2" Hex Head Cap	6	6	6	6	13152E
216	Screw, $\frac{1}{2}$ " x 4" Hex Head Cap	3	3	3	3	13153Q
217 & 218	Seal and Gasket Kit	1	1	1	1	KT509
217	Seal, Rotary Shaft Assembly	1	1	1	1	A33483A
218	Gasket, Shaft Seal Cover	1	1	1	1	31897A
219	Screw, $\frac{1}{2}$ " x $1\frac{1}{4}$ " Hex Head Cap	8	8	8	8	13153F
220 & 220A	Cover and Tube Assembly, Shaft Seal	1	1	1	1	A32564A
220A	Drain Tube	1	1	1	1	35078A
224	Crankshaft and Bearings Assembly *	1	--	--	--	A34555HX
Thru	Crankshaft and Bearings Assembly *	--	1	--	--	A34555KX
233	Crankshaft and Bearings Assembly *	--	--	1	--	A34555LX
	Crankshaft and Bearings Assembly *	--	--	--	1	A34555BX
224	Locknut and Retaining Compound Kit	1	1	1	1	KT366
227	Front Bearing and Retaining Compound Kit	1	1	1	1	KT368
228	Ring, Front Bearing Retainer	1	1	1	1	33144A
229	Crankshaft and Retaining Compound Kit *					
	for Aluminum Pistons	1	--	--	--	KT370
	for Aluminum Pistons	--	1	--	--	KT371
	for Aluminum Pistons	--	--	1	--	KT372
	for Aluminum Pistons	--	--	--	1	KT373
231	Retainer, Rear Bearing	1	1	1	1	31904A
231A & 231B	Rear Bearing and Lock Pin	1	1	1	1	KT353
232	Screw $\frac{5}{16}$ " x $1\frac{1}{2}$ " Hex. Head	4	4	4	4	1736G
233	Crank, Oil Pump Drive	1	1	1	1	33403A
246	Key, $2\frac{1}{2}$ " Crankshaft	1	1	1	1	31994B
247	Screw, Flywheel Hub	1	1	1	1	31956A
248	Washer, Flywheel Hub Screw	1	1	1	1	33495A

460 VMC COMPRESSORS

REAR BEARING COVER REPLACEMENT PARTS
FIGURE 4



VILTER MANUFACTURING CORPORATION

February 2001
Original Issue

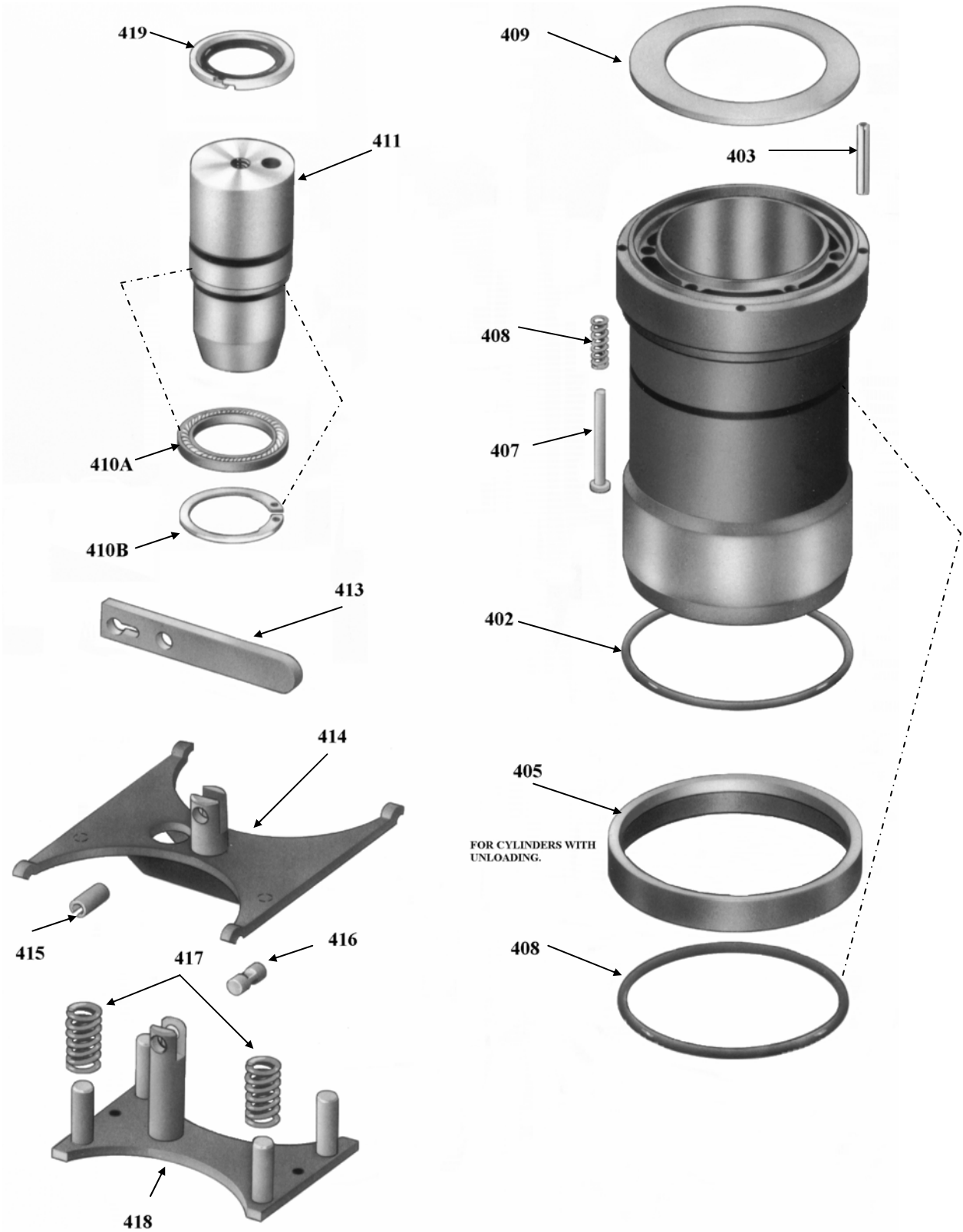
460 VMC COMPRESSORS

REAR BEARING COVER REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS				PART NUMBER
		2	4	6	8	
301 thru 304 & 333	Rear Bearing Cover Assembly Kit	1	1	1	1	KT092
301	Cover, Rear Bearing	1	1	1	1	Order Kit
302	Plug, 3/4" Hex Socket Head Pipe	1	1	1	1	13163E
303	Pin, 3/8" x 1" Dowel	1	1	1	1	2868H
304	Orifice, Oil Metering (not shown)	1	1	1	1	33361A
305	Gasket, Oil Pump Body	1	1	1	1	31899A
306	Oil Pump Assembly	1	1	1	1	A33480A
307	Gasket, Oil Pump Cover	1	1	1	1	31900A
308	Gasket, Oil Pump and Rear Bearing Cover Seal	1	1	1	1	33320A
309	Cover, Oil Pump and Filter Head (used when Oil Cooler not used)	1	1	1	1	36190A
309	Cover, Oil Pump and Filter Head (used when Oil Cooler is used)	1	1	1	1	34760AB
310	Filter Assy., Complete (with Bypass Relief)	1	1	1	1	A35240A
311	Spool Assembly (with Bypass Relief)	1	1	1	1	1448J
311A,312, 313 & 314	Spool – Strainer Tube Assembly	1	1	1	1	1448U
311A, 312 Thru 314 & 315A thru 319 & 321	Filter Assembly (without Shell)	1	1	1	1	1448T
312	Seal, Spool End	1	1	1	1	1448H
313	Strainer Tube	1	1	1	1	1448K
314	Ring, Retaining	1	1	1	1	1448L
315	Recharge (with Bypass)	1	1	1	1	1448C
316	Pressure Plate Assembly	1	1	1	1	1448M
317	Pressure Plate	1	1	1	1	1448N
318	'O' Ring Seal, Pressure Plate (not shown)	1	1	1	1	1448P
319	Spring, Pressure Plate	1	1	1	1	1448Q
320	Plug, Steel Hexagon Head 1/8" Pipe	1	1	1	1	13264A
321	Gasket, Oil Filter Head	1	1	1	1	1448B
322	Filter Shell with Flange and Plug	1	1	1	1	A34623A
322A	Flange, Oil Filter Tank	1	1	1	1	35125A
322B	Tank, Oil Filter	1	1	1	1	34623A
323	Screw, Hexagon Head Cap 7/16" x 2"	4	4	4	4	1689G
324 ***	Instruction/Nameplate (for use with A35241A) (not shown)	1	1	1	1	40680AJ
324 **	Instruction/Nameplate (for use with A35240A) (not shown)	1	1	1	1	40680AT
325	Gauge, 2 1/2", 0-300 PSI, Oil Filter	1	1	1	1	31890A
326	Elbow, 1/4" 90° Female Compression	1	1	1	1	1892B
327	Tubing, 1/4" O.D. Steel	3ft	3ft	3ft	3ft	S1589AA
327A	Tubing, 1/4" O.D. Steel ("AR" – As Required)	AR	AR	AR	AR	S1589AA
328	Tee, 1/4" Compression	2	2	2	2	13239C
329	Connector, 1/4" MPT x 1/4" O.D. Compression	2	2	2	2	13229D
329A	Connector, 1/4" MPT x 1/4" O.D. Compression	2	2	2	2	13229D
330	Valve, 3-Way, Oil Filter	1	1	1	1	2030A
331	Bracket, Valve	1	1	1	1	35106A
332	Control, Pressure Differential	1	1	1	1	1643V
333	Gasket, Bearing Cover	1	1	1	1	31890A
334	Screw, 5/8" x 2" Hexagon Head Cap	10	10	10	10	13152E
335	Screw, 1/2" x 1 1/4" Hexagon Head Cap	8	8	8	8	2796EL

460 VMC COMPRESSORS

CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS
FIGURE 5



VILTER MANUFACTURING CORPORATION

February 2001
Original Issue

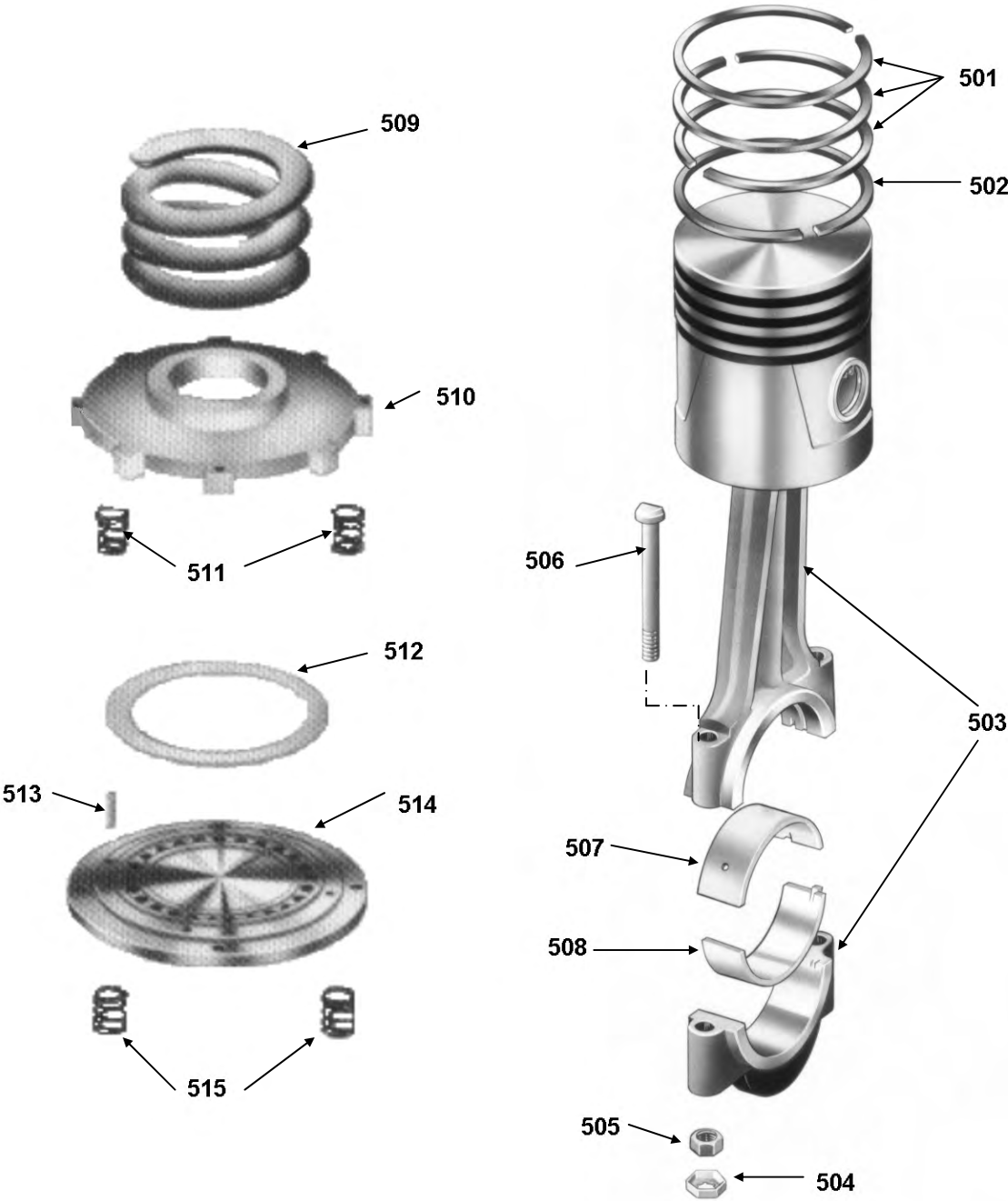
460 VMC COMPRESSORS

CYLINDER LINER AND CAPACITY CONTROL REPLACEMENT PARTS

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS				PART NUMBER
		2	4	6	8	
401, 402 & 403	Cylinder Liner Assembly (for cylinder without unloading)	2	2	2	4	KT475
401, 402 Thru 408	Cylinder Liner Assembly (for cylinder with unloading)	1	2	4	4	KT476
401	Liner, Cylinder	2	4	6	8	34510A
402	Seal, 'O' Ring (upper)	2	4	6	8	2176BH
403	Pin, Roll, 0.125" dia. X 1½" lg.	8	16	24	32	1193Q
405	Ring, Lift	1	2	4	4	A33351A
405A	Ring, Lift	1	2	4	4	35380A
405B	Pin, Roll	4	4	4	4	1193SS
406	Spring, Lift	4	8	16	16	33352A
407	Pin, Lift	4	8	16	16	33350A
408	Retainer, Lift Ring	1	2	4	4	1971A
409	Plate, Suction Valve	2	4	6	8	31909A
410 & 411	Piston & Rings Assy., Cap Red (Gas or Oil †)	1	1	2	2	A35315BX
410 & 411	Piston & Rings Assy., Cap Red (Gas or Oil†)	1	1	2	2	A35315CX
410	Ring Set (PTFE & rubber)	1	1	2	2	2557A
410A	Seal, Unload Piston (Oil only)	1	1	1	1	2639A
410B	Ring, Retaining Unload Piston (Oil only)	1	1	1	1	2638A
411	Piston, Unloader	1	1	2	2	35315A
413 thru 420	Complete Capacity Control Mechanism Assembly * (Low Suction R717 and all Booster)	--	1	2	2	A41788BX
413	Arm, Yoke Lifting	--	1	2	2	41725A
414	Yoke Assembly	--	1	2	2	A33335A
415	Pin, 3/8" x 11/16" lg. Roll	--	1	2	2	1193X
416	Pin, Short Pivot	--	1	2	2	33250B
417	Spring, Unloader Yoke	--	4	8	8	33686A
418	Yoke Guide Assembly	--	1	2	2	A33347A

460 VMC COMPRESSORS

PISTON AND CONNECTING ROD ASSEMBLY
AND SAFETY HEAD REPLACEMENT PARTS
FIGURE 6



VILTER MANUFACTURING CORPORATION

February 2001
Original Issue

460 VMC COMPRESSORS

**PISTON AND CONNECTING ROD ASSEMBLY
AND SAFETY HEAD REPLACEMENT PARTS**

ITEM	DESCRIPTION	QUANTITY REQUIRED PER COMPRESSOR NUMBER OF CYLINDERS				PART NUMBER
		2	4	6	8	
501 thru 508	Piston Rings and Connecting Rod Assy Kit	2	4	6	8	KT573 *
501	Piston Ring, Compression	6	12	18	24	31989M
502	Piston Ring, Oil	2	4	6	8	31989N
503	Piston and Connecting Rod Assy	2	4	6	8	*
504, 507 & 508	Bearing Half and Lock Nut Kit	2	4	6	8	KT575
504	Lock Nut, $\frac{3}{8}$ " , Connecting Rod	4	8	12	16	2028A
505	Nut, Plain Hex $\frac{3}{8}$ "-UNF	4	8	12	16	2027A
506	Bolt, Connecting Rod	4	8	12	16	31955A
507	Bearing Half, Connecting Rod (upper)	2	4	6	8	Order KT575
508	Bearing Half, Connecting Rod (lower)	2	4	6	8	Order KT575
509	Spring, Safety Head	2	4	6	8	35252A
510	Safety Head Yoke Kit (includes 4 of item 513)	2	4	6	8	KT543
511	Spring, Valve	16	32	48	64	33803A
512	Plate, Discharge Valve	2	4	6	8	35080SS
513 & 514	Safety Hd. & Pins Assy (Standard Ammonia Compr)	2	4	6	8	A35082A
	Safety Hd. & Pins Assy (#)	2	4	6	8	A35272A
513	Pin, Roll, 0.187" dia. x $\frac{11}{16}$ " lg.	8	16	24	32	1712F
514	Safety Head	2	4	6	8	**
515	Spring, Valve	8	16	24	32	33803A

NOTES:

- * Piston, wrist pin and connecting rod sold only as a kit.
- ** Shown for disassembly purposes only, order assembly.
- # This Safety Head and Pins Assembly is used on standard Halocarbon and High Suction Pressure Ammonia Compressors. High Suction Pressure Compressors are identified with an 'X' in the serial number.

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